CHAPTER 3
PROFESSIONAL ETHICS

Chapter 3 Professional Ethics

- At the end of this chapter, students should be able to
  - Identify and discuss professional engineering ethics

3.0 Professional Ethics

Contents

- 3.1 The Engineer as a Professional Man
- 3.2 Engineering Ethics and Professionalism
- 3.3 Code of Ethics
- 3.4 Engineers and Society
- 3.5 Global Ethics in Engineering Organizations
- 3.6 Case Studies

3.1 The Engineer as a Professional Man

3.1 The Engineer as a Professional Man

- Engineering is predominantly an employee profession
  - Absence of a "personal practitioner-client relationship"
  - The whole community is the ultimate client rather than the individual clients as in the case with other professions

- The experiential learning is what develops competency and maturity for one cannot exist without the other.

3.1 The Engineer as a Professional Man

- For an individual to be regarded as a professional engineer, he must not only be academically qualified but also have the level of maturity & correct attitude and able to demonstrate competency levels befitting that required by the discipline.

3.1 The Engineer as a Professional Man

- Engineers tend to practice their profession as members of a team
  - Led and managed by senior engineers who are employees
  - Even though they also assume the role of employers in many aspects of their relationships with their juniors

3.1 The Engineer as a Professional Man

- The more senior engineers tend to be concerned with the leadership and management of large resources of men, materials and finance over which they have control

- The juniors will be more involved in the detailed technical practice of the profession

3.1 The Engineer as a Professional Man

- In today's context in major organizations the technical direction comes from higher boards that are formed within the organization to provide guidance and direction in line with the organization's over arching goals and objectives

- These directions and guidelines cascade down to the middle management who translates the actions and the lower rung to execute the action plans

3.1 The Engineer as a Professional Man

- This is done so because of the complexity of goals that necessitates the participation of other elements such as finance, supply chain, legal and human resource that are not necessarily "engineering" per se

3.1 The Engineer as a Professional Man

- Management implies responsibility and in engineering management, the professional engineer is responsible in a very direct sense for control over the resources of the community

- Engineering therefore, is a unique profession in which all of the marks of the professional man have crucial importance:
    - He must have high-level skills and he must develop different skills as his career advances
    - He must have a strong motivation for service because everything he does impinges on the community in some way or other

3.2 Engineering Ethics & Professionalism

3.2 Engineering Ethics & Professionalism

- Engineering is closely involved in human relations in both Public and Private sectors
- A great many of the special problems in personal conduct met by engineers are likely to arise from this fact
- Most engineers encounter problem that far removed from the technical and impersonal

3.2 Engineering Ethics & Professionalism

- Engineering extends the engineers influence on all sphere of human activities
  - In this respect, personal attitudes, relationships and conduct of the engineers have a significant reaching far beyond the realm of purely personal moral
    - Therefore the code of ethics is important
      - To provide guidance for the conduct in all aspect of professional life.

3.2 Engineering Ethics & Professionalism

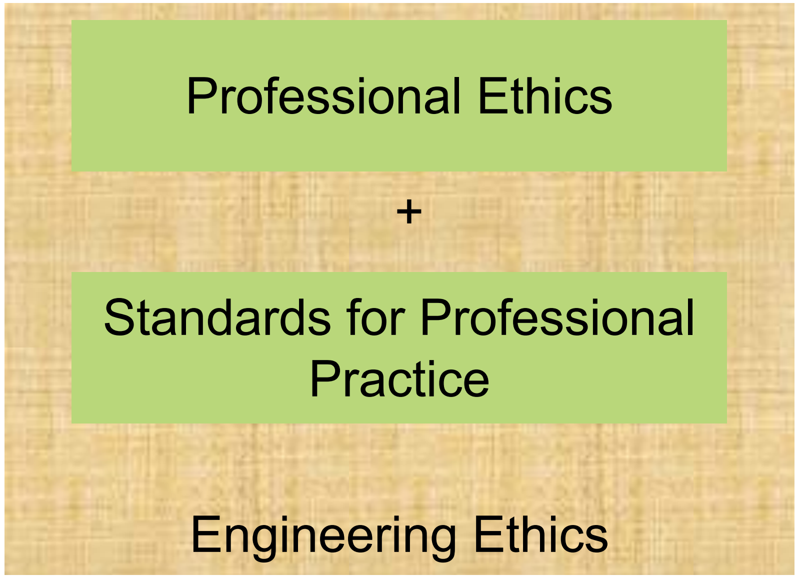
- Morality refers to those standards of conduct that apply to everyone rather than only to members of a special group such as 'Don't Cheat' , 'Keep your promises' etc
- Ethics mean something more than "law" and "moral", it carries an additional connotation of "rightness"
  - The code is not:
    - A list of rules to govern every problem of conduct
    - A broad statement of ideals

3.2 Engineering Ethics & Professionalism

- Professional Ethics refer to those special morally permissible standards of conduct that, ideally, every member of a profession wants every other member to follow, even if that would mean having to do the same.
- Professional Ethics is the category of social and moral awareness of the implication or effects of one's job on the wider community and environment

3.2 Engineering Ethics & Professionalism

- Engineering ethics is professional ethics and sets the standard for professional practice



3.2 Engineering Ethics & Professionalism

- Skills related to engineering ethics
  - Moral awareness
  - Cogent (well-argued) moral reasoning
  - Moral coherence
  - Moral communication
  - Moral reasonableness
  - Respect for persons
  - Tolerance of diversity

3.2 Engineering Ethics & Professionalism

- Ethical dilemmas, or moral dilemmas : situations in which reasons conflict, or in which the application of moral values is problematic, and it is not immediately obvious what should be done

- Steps in resolving ethical dilemmas :
  - Moral clarity : Identify the relevant moral values
  - Conceptual clarity

3.2 Engineering Ethics & Professionalism

  - Informed about the facts: Obtain relevant information
  - Informed about the options: Consider all genuine options
  - Well-reasoned: Make a reasonable decision
- Right-wrong, better-worse
  - Some ethical dilemmas have solution that are either right (obligatory) or wrong (morally forbidden)
  - other dilemmas have more that one permissible solution, some of which are better or worse that others either in some respects or overall

3.2 Engineering Ethics & Professionalism

- The meanings of Responsibility:
  - **Obligations**
    - Are the types of actions that are morally or legally mandatory
    - Some obligations are incumbent on each of us, such as to be honest, fair, and decent
    - Other obligations are role responsibilities, acquired when we take on special roles such as parents, employees, or professionals
    - Morally admirable engineers accept their obligations and are conscientious in meeting them.

3.2 Engineering Ethics & Professionalism

- **Accountable**
  - Being answerable for meeting particular obligations, that is, liable to be held to account by other people in general or by specific individuals in positions of authority
  - We can be called upon to explain why we acted as we did, perhaps providing a justification or perhaps offering reasonable excuses
- **Duty of care**
  - A legal obligation imposed on an individual requiring that they adhere to a standard of reasonable care while performing any acts that could foreseeable harm others
  - It is the first element that must be established to proceed with an action in negligence

3.2 Engineering Ethics & Professionalism

- Wrongdoing
  - Voluntary Wrongdoing
    - Voluntary actions occur when we knew what we were doing was wrong and we were not coerced
    - Some voluntary wrongdoing is recklessness, that is, flagrant disregard of known risks and responsibilities
    - Other voluntary wrongdoing is due to weakness of will, whereby we give in to temptation or fail to try hard enough

3.2 Engineering Ethics & Professionalism

- Negligence
  - Negligence occurs when we unintentionally fail to exercise due care in meeting responsibilities
  - We might not have known what we were doing, but we should have

3.3 Code of Ethics

3.3 Code of Ethics

- The Code of Ethics is a statement of the principles of "rightness", of broad scope and with enough detail to enable the reader to have an understanding of the requirements and its compliance
- The Codes of Ethics for Engineers state the moral responsibilities of engineers as seen by the profession and as represented by a professional society

3.3 Code of Ethics

- The essence of all professional codes is that the professional must be worthy, through his conduct, of the trust placed in him by the community and his colleagues and translating into morally justified actions all the time

3.3 Code of Ethics

- It is about the upholding and adherence to the good "values" that are impregnated in the codes to do goodness and not anything that is detrimental and degrading to the profession and to the very least the individual

3.3 Code of Ethics

- Values such as integrity, honesty, sympathy, upholding human rights, preserving humanity and its environment etc are only some that contribute to the foundation of the codes

3.3 Code of Ethics

- This has given rise to a universal rule of life for every engineer who is aspired to the true professional status:
  - To act in every situation in a manner that will add to the confidence and esteem in which his profession is held by the community

3.3 Code of Ethics

- This universal rule has resulted that engineering profession has remarkably few cases of breach of ethics requiring disciplinary action against members
- Universal set of qualities which pertain to any job or occupation:-
  - Dedication
  - Diligence
  - Honesty

3.3 Code of Ethics

- Second set of positive qualities are those which are particular to the job or occupation at hand:-
  - A teacher must have the ability to communicate effectively with her pupils
    - Some are gifted with specific qualities, but many have to learn and develop

3.3 Code of Ethics

- The whole social system has a large hand in determining the wider effect of one's work.
- But this does not means that one completely paralyzed.
- Eg.
  - Environmental impact assessment can be more seriously considered by architects, engineers and developer and not seen as extraneous program.
  - Economists and economic advisers can look more at human side of the economy and that the needs of the poor have priority over the wants of the rich and that the rights of the workers are more important than the maximization of profit.
  - 1997-98 Indonesian experience
  - France revolution (initiated 1789)

3.3 Code of Ethics

- The third set is the social and moral awareness of the implication or effect of ones job on the wider community and environment.
  - Where professional ethics cannot be avoided
  - A researcher cannot absolve himself of moral implication of his work simply by taking decisions according to some kind of purely scientific criteria devoid of value implication
  - A general massing his army at the border of his country for some military exercise without consenting the neighbouring country.

3.3 Code of Ethics

- The fact is that:-

"All of us exist in social context which does not disappear however much one wants to be uninvolved"

- The third set of professional ethic is a very difficult to dealt with.
  - One cannot escape the fact the one's work will effect the wider community. Yet one (to a large extent) does not have complete control over many factors that dictate the course of one's action or decisions in a work.

3.3 Code of Ethics

- We can conclude that moral responsibilities need to become an integral part of popular professional ethics.
  - "Had I known, I would rather have been a watchmaker"
    - Einstein on Hiroshima and Nagasaki

(Example of moral responsibility)

3.3 Code of Ethics

- The fact that engineer's work and relationships with colleagues and clients are so much in the open that are purely moral sanctions prove to be sufficient and this a matter of pride
  - "A profession is no better than its individual member"

3.3 Code of Ethics

- When we speak of a Code of Ethics, we are not talking about law. In the Code of Ethics, our concern is with what is morally right or wrong and not compromising the legal standing
- Situations which require the Professional Engineer to consider the morality of his actions arise under circumstances in which they may exist conflict of interest between the individual professional and any or all of the entities with which he has to interact i.e. Community, Employer, Clients and/or Peers

3.3 Code of Ethics

- The professional owes a duty of care towards those he serves in ensuring that their interests are protected, and in this respect, there is a guideline which is what the Code of Ethics is all about
- The essential roles of codes of ethics:
  - serving and protecting the public
  - providing guidance
  - offering inspiration
  - establishing shared standards
  - contributing to education
  - deterring wrongdoing
  - strengthening the profession’s image

3.3 Code of Ethics

- The three major Professional Engineering bodies in Malaysia have complementary functions in the regulation of professional conduct
- All three bodies have their own Code of Ethics designed to suit their specific requirements according to the objectives for which each body is constituted:
  - IEM Code of Ethics
  - BEM Code of Professional Conduct
  - The ACEM Code of Ethics

3.3 Code of Ethics

- Other sample code of ethics include:
  - NSPE: National Society of Professional Engineers Code of Ethics
  - IEEE: The Institute of Electrical and Electronic Engineers Code of Ethics
  - ASME: American Society of Mechanical Engineers Code of Ethics

3.3.1 Board of Engineers' Code of Professional Conduct

- This "Code of Professional Conduct" has the force of law and breach of any of the rules embodied in the BEM code may subject the offender to penalties provided for under the Engineer's Act including the ultimate penalty of de-registration
  - Therefore, in viewing the role of the BEM as a regulating body, its power to act in law must be taken into account

3.3.1 Board of Engineers' Code of Professional Conduct

- BEM code can at best distinguish between what is legal and what is not, and may be regarded as the baseline or minimum level of ethics that ought to be maintained
- The rules in the code are concerns with what an Engineer shall or shall not do in the course of his employment or private practice and are extremely clear cut and unambiguous
- All these rules are concerned with the prevention of situations which may possibly give rise to conflict of interest between the Engineer, his employer or his clients

3.3.1 Board of Engineers' Code of Professional Conduct

- Under Section 15 of the Engineers' Act 1967, the Board may order the cancellation of the registration of any engineer, if:-
  - He is guilty of fraud, dishonesty or moral turpitude;
  - He accepts illicit commission;
  - He fails to disclose to his client any vested financial interest in his dealings with the client

3.3.2 IEM Code of Ethics

- The Code of Ethics of IEM, lays down general guidelines for the conduct of members vis-à-vis his relationships and transactions with:
  - The community
  - The Employer
  - Clients
  - Peers
- The IEM Regulations on Professional Conduct tend to be general because the IEM comprises a very wide cross-section of engineering disciplines as well as types of professional employment and businesses

3.3.2 IEM Code of Ethics

- IEM Code embraces many areas involving moral and philosophical considerations including public safety and health, conservation of resources and environment, upgrading of technology, assuming responsibility within one's competence
- The IEM code also includes the do's and don'ts in the conduct of affairs between Engineer and employee, clients and peers
  - While the dos and don'ts are clear cut and easily understood, the moral and philosophical issues can be subject to various interpretation

3.4 Engineers & Society

3.4 Engineers and Society

- We are responsible for our own image
  - **Question 1**
  - Have engineers receive due recognition from society?
  - **Question 2**
  - Does engineer rank high in social standing?

From survey, conclusion made by engineers themselves;-

1) Their works do not receive due recognition
2) Their status in society is ranked low

Why they made these conclusions?

Example

1) Vacant engineering posts stating required qualification of degree/diploma holder or without degree but with the necessary experience.
2) Computer scientists involved in systems and hardware are called system engineers even though they do not have an engineering degree.

3.4 Engineers and Society

- It is unfortunate that much of what we call engineering work can be and are being done by non-engineers
- E.g
  - Everybody can make pressure vessels as long as they get the necessary approval from the relevant government bodies.
  - Anybody can sell engineering equipment
  - The law does not forbid a so-called engineering company from operating without qualified engineers.

3.4 Engineers and Society

- On the other hand, a pharmacy is not allowed to operate without a pharmacist and likewise, legal firms, clinics and architect firms are restricted in the same manner.

3.4 Engineers and Society

- Question
  - Can one describe an engineer as catalogue engineer?
    - Could be for Malaysian engineers, why?

Because;

1. We refer to catalogue most of the times
   - to select equipment from catalogues
   - to design pressure vessels, say, according to standardized codes.
   - to design buildings and structures against the accepted code

➔ Engineers' works almost reduce to looking from catalogue to catalogue or from one code to another of matching specification

3.4 Engineers and Society

- The big question
  - When does one require engineer?

Not often

In the eyes of the general public, engineering profession is for those graduates who are doing much of the 'Catalogue Engineering' with nominal demonstration of skill.

3.4 Engineers and Society

- Why this is happening?
  - The fact;
    - that the general public do not realize that there exist no easy system for assessing an engineer's skill and
    - unlike other profession, an engineering project is seldom accredited to any one engineer.

3.4 Engineers and Society

- Only we ourselves know our worth and even though unqualified persons can come out with the same design following 'catalogued procedure', we by virtue of our training, can check the soundness of the design using the first principle.
- The solution
  - The ability to check the soundness of the design using the first principle that needed to be projected to the general public.

3.4 Engineers and Society

- What should we do?
- To remove any miss conception, engineer should set themselves to serve the community in more conspicuous activities so that they may broaden their interests and indirectly advertise and enhance the engineering profession and status
  - Provide more engineering advices to the community and less ‘follow the catalogue’ solution.

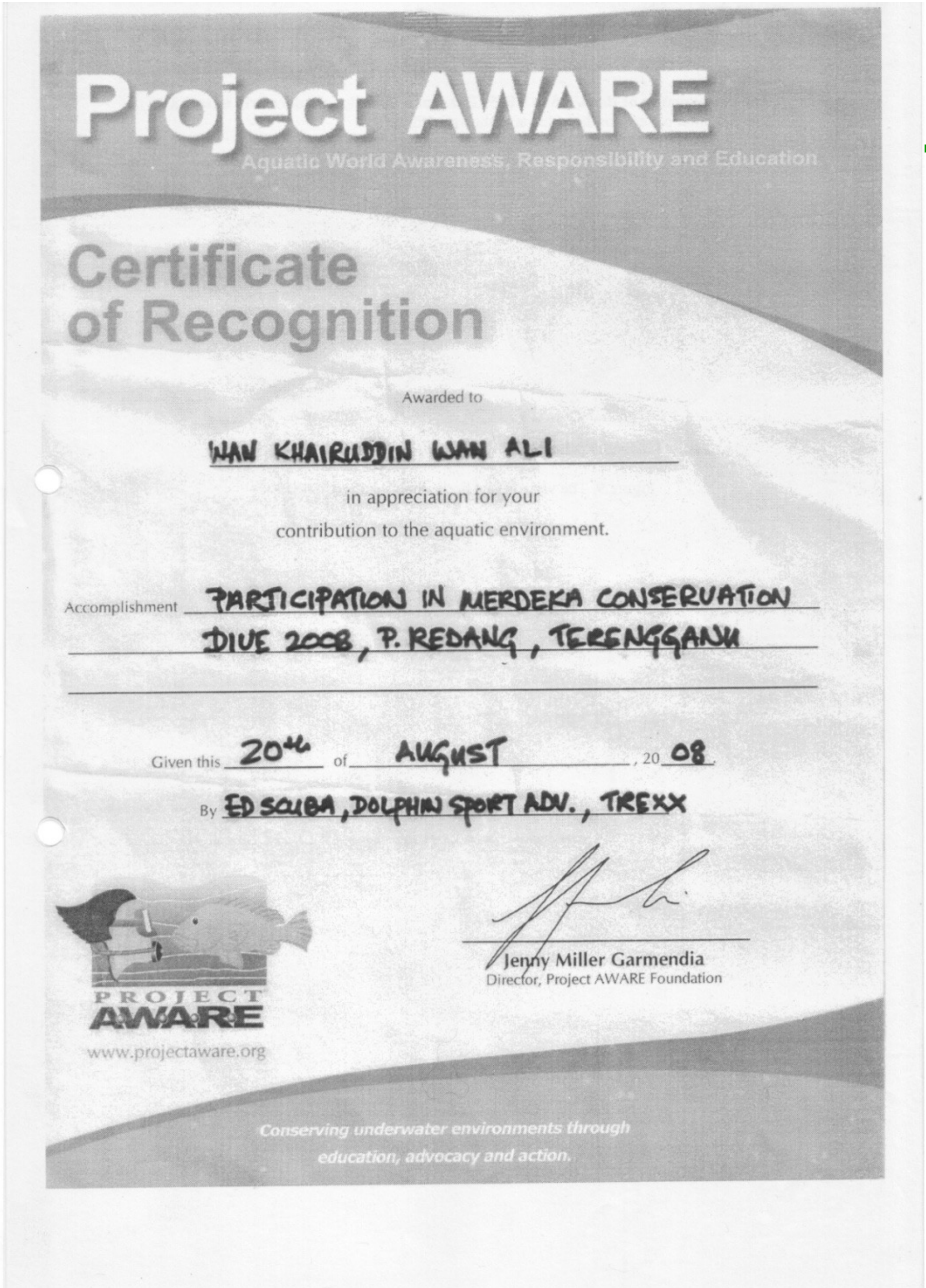
3.4 Engineers and Society

- We should strive very hard toward greater public involvement if we are to get any recognition as tribute paid to engineers when the public fully conscious of environment and basic human needs

3.4 Engineers and Society

- By associating and participating, the professional engineer would also cultivate a wide angle view of his work
  - For he should know what is happening in other spheres of activity and how his work fits into the social pattern
- Engineer should write more
  - "Reading maketh a full man,
    Conference maketh a ready man,
    Writing maketh an exact man"

3.4 Engineers and Society



Project AWARE

Aquatic World Awareness, Responsibility and Education

Certificate of Recognition

Awarded to

WAN KHAIRUDDIN WAN ALI

in appreciation for your contribution to the aquatic environment.

Accomplishment PARTICIPATION IN MERDEKA CONSERVATION DIVE 2008, P. REDANG, TERENGGANU

Given this 20th of AUGUST, 20 08

By ED SCUBA, DOLPHIN SPORT ADV., TREXX

Jenny Miller Garmendia

Director, Project AWARE Foundation

PROJECT AWARE

www.projectaware.org

Conserving underwater environments through education, advocacy and action.

3.4 Engineers and Society

- If we want the public to appreciate our work then we must first do an excellent job
- We must be aware of technological advancements
  - Be designers instead of users and
  - Get involved in research and development
- We have the brains, the technology and the expertise
  - We just need effort and commitment from ourselves
- Engineers provide not only the necessary human resources for the infrastructure development of a country but also important devices necessary for the welfare of the public

3.4 Engineers and Society

- In the course of discharging their duties and responsibilities, engineers do have influence on certain decisions
- These decisions if made based on the self-interests of individuals or a minority, then the interests and welfare of the wider community becomes of secondary importance. Corruption is an extreme example of this.

3.4 Engineers and Society

- Because of the significance and influence of professionals in society, the value systems which govern their lives and attitudes are needless to say, of great importance.
- Engineers need to understand how their work affects public life
- As managers, entrepreneurs, consultants & government officials, engineers provide many form of leadership that should include moral leadership in developing and implementing technology within their profession & communities

3.5 Global Ethics in Engineering Organizations

3.5 Global Ethics in Engineering Organizations

- Globalization refers to the increasing integration of nations through trade, investment, transfer of technology, and exchange of ideas and culture.

- Global interdependency affects engineering and engineers in many ways as in multinational corporations where moral challenges arises:
  - Who loses jobs at home when manufacturing is taken offshore?
  - What does the host country lose in resources, control over its own trade, and political independence?
  - What are the moral responsibilities of corporations and individuals operating in less economically developed countries?

3.5 Global Ethics in Engineering Organizations

- Technology transfer is the process of moving technology to a novel setting and implementing it there

- Technology includes both hardware (machines and installations) and technique (technical, organizational, and managerial skills and procedures)

- A novel setting is any situation containing at least one new variable relevant to the success or failure of a given technology: example, the setting may be a foreign country

- Appropriate technology refers to identification, transfer, and implementation of the most suitable technology for a new set of conditions and it includes social factors

3.6 Case Studies

Case Study #1 – Bhopal Tragedy

Case study #1: BHOPAL

- Union Carbide in 1984 operated in 37 host countries in addition to its home country, USA
  - On Dec.3rd, 1984, the operators of Union Carbide's plant in Bhopal, India became alarmed by a leak and overheating in a storage tank
  - The tank contained methyl isocyanate (MIC), a toxic ingredients used in pesticides
  - Within 1 hour, the leak exploded that sent 40 tons of deadly gas into the atmosphere
- This is the worst industrial accident in history:
  - 500,000 persons exposed to the gas
  - 2500 to 3000 deaths within a few days
  - 10,000 permanently disabled
  - 100,000 to 200,000 injured
  - 10 years later, 12,000 death claims and 870,000 personal injury claims had been submitted
  - only $90 million of Union Carbide's settlement had been distributed

What went wrong?

- The disaster was caused by a combination of extremely lax safety procedures, gross judgment errors by local plant operators, and possible sabotage with unintended consequences
- Greater sensitivity to social factors was needed in transferring chemical technology to a country foreign to the supplier of the technology
- Government of India required the Bhopal plant to be operated entirely by Indian workers
- Union Carbide at first trained the plant personnel in its West Virginia plant
- US engineers make regular on-site safety inspections
- In 1982, financial pressures relinquish its supervision of safety at the plant

What went wrong?

- 2 years later, safety practices eroded:
  - Personnel problems:
    - high turnover of employees
    - failure to properly train new employees
    - low technical preparedness of local labour pool
    - workers handling pesticides learned from personal experience than from safety manuals
    - even after suffering chest pains & vomiting, they fail to wear safety gloves and masks due to high temperature a result of lack of air-conditioning
  - Move away from US standards (contrary to Carbide's written policies) to lower Indian standards
  - Extreme hazards:
    - Tanks storing the MIC gas were overloaded (manual specifies that tanks must not be filled > 60%) extra space needed in emergencies to dilute the gas
    - Standby tank was not empty for use as an emergency dump
    - Tanks were supposed to be refrigerated but refrigeration was shut down to cut cost making the tank temperature 3 to 4 times what they should have been

What went wrong?

- Sabotage:
  - A disgruntled employee unscrewed a pressure gauge and inserted a hose into it not realizing that it would cause immense damage
- Negligence:
  - A new worker was to flush out some pipes & filters. He closed the valves but failed to insert the safety disks to back up the valves in case they leaked. He knew that valves leaked but did not check for leaks: *It was not my job!* The safety disks were the responsibility of the maintenance dept., and the position of second-shift supervisor had been eliminated
- By the time they noticed a gauge showing mounting pressure and began to feel the sting of leaking gas, their emergency procedures were unavailable:
  - A venting gas scrubber to neutralize the gas was shut down because it was assumed to be unnecessary during times when production was suspended
  - Flare tower to burn off escaping gas missed by the scrubber was inoperable because a section of the pipe connecting it to the tank was being repaired
  - Workers sprayed water 100 ft to the air but the stack was 120 ft
  - Within 2 hours , most of the chemicals had escaped and form a deadly cloud over hundreds of thousands of people in Bhopal

What went wrong?

- there were thousands of squatters in the areas surrounding the plant with hopes to find employment as well to take advantage of available electricity and water
- None of the squatters had been officially informed of the danger posed by the chemicals produced next door to them
- No emergency drills
- No evacuation plans

Question of Moral Responsibility

- What are the moral responsibilities of Multinational Corporations like Union Carbide?

    - The view that actions are morally right within a particular society when they are approved by law, custom etc.

    - Retains precisely the same practices endorsed at home, never making any adjustments to a new culture

    - The view that moral judgments are contextual in that they are made in relation to a wide variety of factors including the customs of other cultures

Current issues : LYNAS, what is your opinions?

Case Study #2 – Piper Alpha

Case study 2: The Oil Rig Piper Alpha

- Piper Alpha was a North Sea oil production platform operated by Occidental Petroleum (Caledonia) Ltd. The rig began operation in producing crude oil in 1976 but later was converted to a gas production platform which had an impact later as the disaster unfolds
- Piper Alpha produced crude oil and natural gas from 24 wells in 3 separate pipelines
- The rig is located 193km off the north-east coast of Scotland and at that time it was the oldest platform in the North Sea oilfield
- On the fateful day 6 July 1988, there were approximately 229 men working on the rig

What went wrong?

- At 1200pm local time on the 6 July, one of the two condensate pumps that displaced condensate to the shore terminal had its 'pressure safety valve' removed for routine maintenance. Since it could not be returned to operation in time, the pipeline was temporarily sealed using a blank piece (disc). The duty engineer at that time certified the pump as non operational
- At 6pm the day shift ended and the night shift commenced. There was not enough time or opportunity for the engineer to handover the certificate to the night shift operators so it was left on a desk in the control room. Nobody then knew of the temporarily sealing and that the condensate pump was not to be switched on at any cost
- The Piper Alpha rig was fitted with an automatic fire fighting system which will turn on when a fire breaks out. On that day the fire pumps were set to manual. It appears that it was a regulation that the fire pumps be set to manual if there were divers in the sea in the vicinity of the rig as the suctions for the pumps might suck the divers in. This too had an impact later when the fire broke out

What went wrong?

- The condensate (natural gas liquid NGL) was being pumped with the only pump that was operational at that time and at 9.45pm, it stopped. Duty operators tried to start it up but failed. The entire operation depended on this only pump and as such the duty engineers only had a short time to restart the pump. Failing which the whole power supply will fail completely
- At 9.55pm the condensate pump missing the pressure safety valve with the sealed pipe was started. Resulting in overpressure in the pipe and the extreme back pressure caused the pipe to rupture and an explosion ignited into a big fire
- As the rig was not meant for gas production, the firewall was only designed to handle fire and not gas explosion. The bolted firewall buckled when the explosion occurred and the plates strewn all over and ruptured more pipes which poured more fuel into the fire

What went wrong?

- Nobody could do anything as it happened very quickly despite the operators could hear the gas leaking and the alarms sounding. Even though a custodian managed to press the emergency stop button to shutoff all valves in the sea lines ceasing all production of oil and gas, it was not helping
- The control room was deserted and there was total loss of control of emergency procedures. Nobody was giving instruction and taking charge of the situation
- What aggravated the situation was oil from two other fields the Tartan and Claymore continued to be pumped into Piper Alpha. The managers from both fields did not shut down operations. Piper Alpha would have burnt out its own fuel, but instead more fuel was pumped in

CASUALTIES

- A total of 167 men perished in that disaster out of 229. 165 from the rig and 2 from a rescue boat that was there to evacuate the survivors
- Most of them died because of suffocation due to toxic fumes that developed after the gas leak set off the blasts

Lessons Learnt

- It was the lack of knowledge on the status of the pumps that lead the manager to assume the condensate pump was good to be started
- The structural design of the rig especially the firewall which was meant to be for oil production was not refurbished to cater for gas production
- The automatic fire pumps were set on manual and hampered the firefighting action
- Control room deserted caused chaos and lacking in supervision on emergency evacuation and firefighting

.............End of Chapter 3