UNIVERSITI SAINS MALAYSIA

2nd. Semester Examination
2002/2003 Academic Session
Peperiksaan Semester Kedua
Sidang Akademik 2002/2003

February / March 2003

EAV 587/4 – Environmental Risks Assessment
(Penilaian Risiko Alam Sekitar)

Time : 3 hours
Masa : 3 jam

Instruction to candidates:
Arahan Kepada Calon :

1. Ensure that this paper contains **SEVEN** (7) printed pages.
1. *Sila pastikan kertas peperiksaan ini mengandungi **TUJUH** (7) muka surat bercetak sebelum anda memulakan peperiksaan ini.*

2. This paper contains **SIX** (6) questions. Answer **FIVE** (5) questions only. Marks will be given to the **FIRST FIVE** (5) questions put in order on the answer script and **NOT** the **BEST FIVE** (5).
2. *Kertas ini mengandungi **ENAM** (6) soalan. Jawab **LIMA** (5) soalan sahaja. Markah hanya akan dikira bagi **LIMA** (5) jawapan **PERTAMA** yang dimasukkan di dalam buku mengikut susunan dan bukannya **LIMA** (5) jawapan terbaik.*

3. All questions carry the same mark.
3. *Semua soalan mempunyai markah yang sama.*

4. All questions **CAN** answered either in English or Bahasa Malaysia or combination of both languages..
4. *Semua soalan boleh dijawab dalam Bahasa Inggeris atau Bahasa Malaysia ataupun kombinasi kedua-dua bahasa.*

5. Write answered question numbers on the cover sheet of the answer script.
5. *Tuliskan nombor soalan yang dijawab di luar kulit buku jawapan anda.*

...2/-

1. (a) A drilling machine has a malfunctioning rate of 1 million. The drill rotates at 200 rpm. Assume that the machine is used for 500 operations per day, each operation last for average 2 minutes. Calculate the accident rate in week if the working day is 6 days per week.

(3 marks)

(a) Sebuah mesin penggerudi mempunyai kadar ketidakfungsian 1 juta. Penggerudi tersebut berputar pada 200 rpm. Dengan menganggap mesin ini digunakan untuk 500 operasi setiap hari dan setiap operasi mempunyai masa purata 2 minit. Kirakan kadar kemalangan dalam unit minggu sekiranya hari bekerja ialah 6 hari seminggu.

(3 markah)

(b) Discuss hazards and injuries associated with machine and describe the engineering control and management control to minimize the risk of accident.

(10 marks)

(b) Bincangkan bahaya dan kecederaan berkaitan mesin dan terangkan kaedah kawalan kejuruteraan dan pengurusan untuk meminimakan risiko kemalangan.

(10 markah)

(c) Discuss electrical current effect on human and factors influencing severity of injuries.

(7 marks)

(c) Bincangkan kesan arus eletrik kepada manusia dan faktor-faktor yang mempengaruhi keparahan kecederaan akibatnya.

(7 markah)

2. (a) As an environmental impact assessor you have been given a task to carry out a full environmental risk assessment (ERA) for a recently completed building. The building is ten stories high and holds several chemical laboratories at various level and heavy machineries on its ground floor. Describe in detail how you are going to comprehensively perform this assessment.

(17 marks)

(a) Sebagai seorang jurutera penilai risiko alam sekitar, anda telah diberikan tugas untuk menjalankan penilaian risiko alam sekitar (ERA) untuk sebuah bangunan yang baru siap. Bangunan ini setinggi sepuluh tingkat dan mempunyai beberapa makmal kimia pada beberapa aras yang berbeza dan mesin berat terletak pada tingkat bawah. Jelaskan secara terperinci bagaimana anda akan menjalankan penilaian ini secara komprehensif.

(17 markah)

...3/-

(b) Choose 3 and define each of them briefly.

i. Resistivity
ii. Current
iii. Fire ratings
iv. Fire tetrahedron
v. Flame detectors

(3 marks)

(b) Pilih 3 dan berikan definisi ringkas setiap satu.

i. Resistivity
ii. Current
iii. Fire ratings
iv. Fire tetrahedron
v. Flame detectors

(3 markah)

3. (a) Name any **THREE (3)** related legislation for environmental risks in Malaysia.

(3 marks)

*(a) Namakan **TIGA (3)** perundangan yang berkaitan dengan risiko alam sekitar di Malaysia.*

(3 markah)

(b) A new secured landfill for hazardous waste treatment is being constructed at a remote area in Penang state. Briefly discuss the qualitative risk assessment (failure scenario) for construction of this landfill.

(7 marks)

(b) Suatu kambus tanah terjamin untuk olahan sisa berbahaya sedang dalam pembinaan di suatu kawasan terpencil di negeri Pulau Pinang. Secara ringkas, bincangkan penilaian risiko kualititatif (scenario kegagalan) untuk pembinaan kambus tanah ini.

(7 markah)

(c) Discuss briefly **FIVE (5)** factors that may affect the health risk in water treatment process for public water supply.

(5 marks)

*(c) Bincangkan dengan ringkas **LIMA (5)** faktor yang akan memberi kesan kepada risiko kesihatan dalam proses olahan air untuk bekalan air awam.*

(5 markah)

...4/-

(d) Discuss briefly **FIVE (5)** factors that may contribute to accident at any construction sites.

(5 marks)

*(d) Bincangkan dengan ringkas **LIMA (5)** faktor yang akan memberi kesan kepada risiko kesihatan dalam proses olahan air untuk bekalan air awam.*

(5 markah)

4. On September 2000, a vapour cloud explosion occurred in MZAB Sdn. Bhd. The explosion was caused by the released of an equimolar mixture of propane and butane from a storage tank. The overpressure was estimated to be 5.0 kPa which shatters large and small windows as far away as 4.5 km from the source of ignition. Estimate the quantity of hydrocarbon released.

Data:

Heat released from propane	= 2056.0 kJ/g-mol
Heat released from butane	= 2702.6 kJ/g-mol
Propane molecular weight	= 44.0 kg/kg-mol
Butane molecular weight	= 58.0 kg/kg-mol
Equivalent energy of TNT	= 4692.8 kJ/kg

(20 marks)

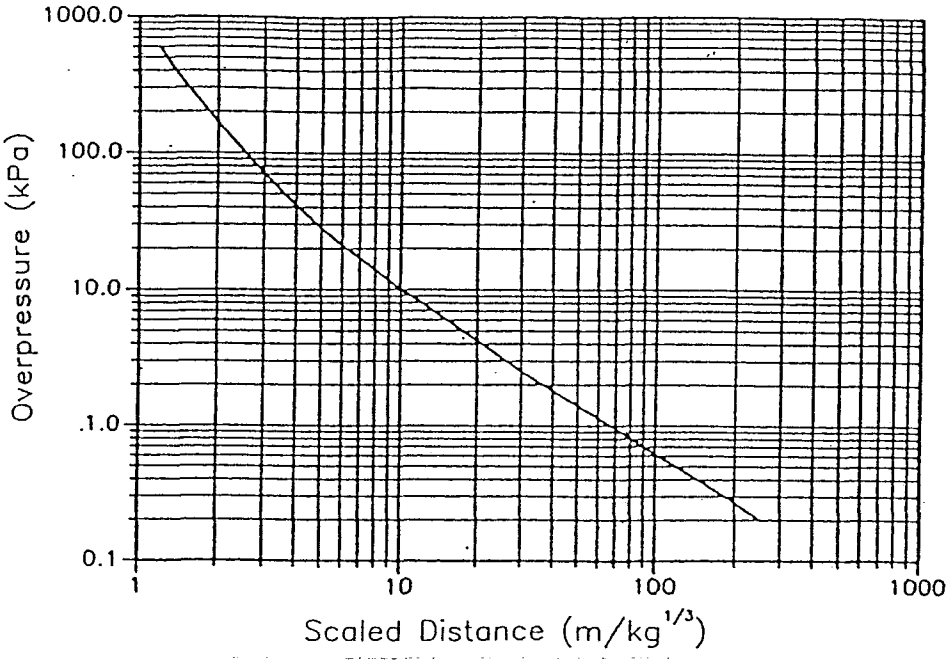
Pada bulan September 2000, satu letupan awan berlaku di MZAB Sdn. Bhd. Letupan tersebut disebabkan oleh pembebasan campuran sama molar propana dan butana daripada sebuah tangki simpanan. Tekanan lebih telah dianggarkan sebanyak 5.0 kPa yang mengakibatkan tingkap cermin besar dan kecil pecah sejauh 4.5 km daripada punca letupan. Kirakan kuantiti hidrokarbon yang terbebas.

Data:

Haba pembebasan daripada propana	=	*2056.0 kJ/g-mol*
Haba pembebasan daripada butana	=	*2702.6 kJ/g-mol*
Jisim molekul propana	=	*44.0 kg/kg-mol*
Jisim molekul butana	=	*58.0 kg/kg-mol*
Tenaga setara TNT	=	*4692.8 kJ/kg*

(20 markah)

...5/-



Rajah 1.0 : Korelasi antara tekanan lebih dan jarak berskala (Unit SI)

Table 1: DAMAGE PRODUCE BY OVERPRESSURE

Overpressure (psi)	Damage
0.03	Large glass windows which are already under strain broken
0.04	Loud noise. Sonic boom glass failure
0.15	Typical pressure for glass failure
0.3	95% probability of no serious damage
0.5-1	Large and small windows usually shattered
0.7	Minor damage to house structures
1	Partial demolition of houses, made uninhabitable
1.3	Steel frame of clad building slightly distorted
2-3	Non-reinforced concrete or cinder wall shattered
2.3	Lower limit of serious structural damage
3	Steel frame building distorted and pulled from foundation
3-4	Rupture of oil storage tanks
5	Wooden utility poles snapped
5-7	Nearly complete destruction of houses
7	Loaded train wagons overturned
9	Loaded train boxcars completely demolished
10	Probable total destruction of building
300	Limit of crater lip

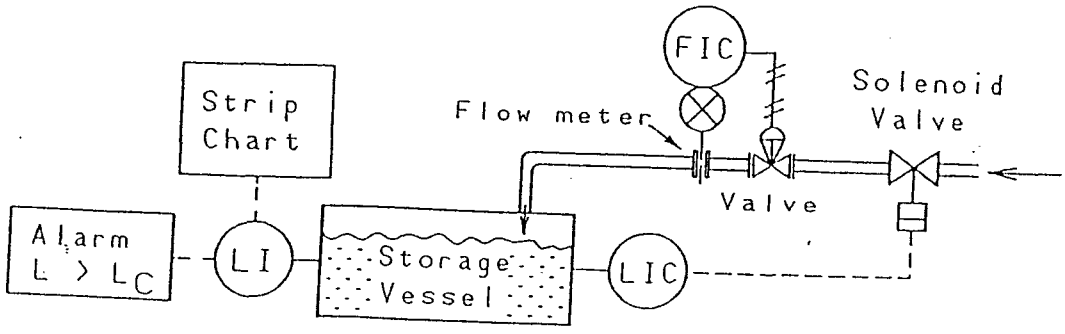
...6/-

5. Figure 2.0 shows a storage tank system equipped with a high level alarm and a high level shutdown system in order to prevent overfilling. The high level shutdown system is connected to a solenoid valve that stop the flow of input stock. Develop a fault tree of the top event "storage tank overflows".

(20 marks)

Rajah 2.0. menunjukkan satu sistem tangki simpanan yang dilengkapi dengan sistem penggera aras tinggi dan sistem penutupan aras tinggi bagi mengelakkan pengisian berlebihan. Sistem penutupan aras tinggi itu disambung kepada injap solenoid yang dapat menghentikan aliran masuk stok. Bangunkan pokok kegagalan untuk peristiwa teratas "tangki simpanan terlebih isi".

(20 markah)



Rajah 2.0 : Sistem kawalan aras dengan penggera

6. (a) Discuss in detail the procedures and processors of risk evaluation that had been conducted on Civil Engineering or School of Chemical Engineering.

(10 marks)

(a) Huraikan prosedur dan proses penaksiran risiko (risk evaluation) yang telah dijalankan di Pusat Pengajian Kejuruteraan Awam atau Pusat Pengajian Kejuruteraan Kimia.

(10 markah)

(b) An important component of any risk characterization is the identification and discussion of uncertainties. Discuss these uncertainties in the exposure assessments.

(5 marks)

(b) Salah satu bahagian terpenting dalam pencirian risiko ialah mengenalpasti dan membincangkan perkara-perkara ketidakpastian. Bincang mengenai ketidakpastian dalam penilaian pendedahan.

(5 markah)

(c) Determine the risks of male working in an environment of chloroform at 2 ppm for 8 hr./day, 5 day/week, 52 week/year and 60 years, given the following linear risk model for nasal carcinomas :

Risk = P (excess) = 0.027 (close in ppm)

(5 marks)

...7/-