

Name: _____ Student ID _____

Prince of Songkla University
Faculty of Engineering

Exam: Mid-Term, Semester I

Date: August 5, 2012

Subject: 230-334 – Safety

(Safety in Chemical Engineering Operations)

Academic Year: 2012 – 2013

Time: 1:30 – 4:30 PM

Room: A400

ทูลจรตในการสอบทูลขงน้ันต่าค้ือ ปร้บตกในรายวขที่ทูลจรต แลพะพ้กการเรยรน 1 ภาคการศกษา

CLOSED BOOK EXAM: No notes and no sheets are allowed.

Points Distribution (For Grader Only)		
Part	Points Value	Score
I	28	
II	49	
III	20	
IV	28	
V	35	
VI	30	
Total	190	

Exam prepared by
Ram Yamsaengsung
July 24, 2012

**PLEASE CHECK TO MAKE SURE THAT
YOU HAVE ALL 13 PAGES OF THE EXAM BEFORE BEGINNING
(not including the cover sheet and attachment).
GOOD LUCK!**

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CLOSED BOOK EXAM (No books or notes allowed)

I. FILL IN THE BLANKS (28 points)

1. In a well design facility, the equipment should only take up about _____ % of the entire floor space.
2. An inflammation of the skin that causes an allergic reaction is called _____.
3. The _____ maintains proper keeping of all documents, calculations, reports, procedures and operational logs.
4. To produce a fire, it is necessary to have _____, _____, and _____. This is also known as _____.
5. The _____ appoints the laboratory safety officer and is usually the head of the department.
6. The _____ acts as a liaison with the site safety officer, inspectors of the Health and Safety Executive, and insurance inspectors.
7. For high pressure equipment, the safety devices that must be installed include _____, _____ and _____.
8. The _____ acts as the secretary of the laboratory safety committee.
9. A signature on behalf of the _____ must be present on the safety policy.
10. The _____ area and the _____ area are in charge of ordering and purchasing.
11. The _____ maintains scheduled and recorded inspection, examination, repair and replacement according to statutory, organization, and insurance requirements.
12. Steel supports should give a fire resistance of _____ hours.
13. Two types of human indiscipline that could cause hazards include _____ and _____.
14. _____ are highly toxic by ingestion and are rapidly absorbed by the skin producing intensive burns.
15. The _____ acts as the chairperson of the laboratory safety committee.
16. For vibration and noise, damage occurs at about _____, for a short period of exposure and _____ for continuous noise.
17. The sudden release of vacuum is called _____.

4. List 6 safety equipments, instruments, or devices that were posted by your friends in the Safety Facebook group (not the personal protective equipment). **(6 points)**

5. Select 3 labs from our Chemical Engineering Department that were presented by your classmates and list 3 suggestions that should be implemented in each lab. **(9 points)**

6. Discuss the major steps in a design of a laboratory. What questions must be considered? Why should a lab be modernized? What is a typical option in which modernization can be implemented? **(8 points)**

7. From your answers in Problem 7, draw a layout (floor plan) of a restaurant that you plan to open using the area the size of room S104. Make sure to list of the facilities, equipment, emergency concerns, etc. **(10 points)**

III. CSB VIDEO (20 points)

1. Match the following information with the safety video that it was from?
(20 points)

- (a) Union Carbide, Bhopal
- (b) Cyntron Manufacturer (Acrylic Polymer)
- (c) BP Amoco Polymer Plant (High Performance Nylon)
- (d) MFP Chemical Plant (plastic additives, Tri-allo, cyanurate - TAC)
- (e) Death in the Oil Field

- ___ 1. Maintenance workers were killed when they tried to clean out plastics from a waste tank.
- ___ 2. A lid acetylene torch was inserted into a storage tank to test for the presence of hydrocarbons.
- ___ 3. Highly toxic gas was released due to improper scale-up of process.
- ___ 4. A toxic chemical release from a pesticide plant in India killed thousands of people and led to the establishment of the CSB.
- ___ 5. The overhead heat exchanger could not handle the amount of heat produced by the production process.
- ___ 6. A 12% increase in production caused a runaway reaction leading to the release of toxic vapor clouds and a violent explosion.
- ___ 7. Three maintenance workers were killed during a welding operation.
- ___ 8. Slow decomposition took place releasing large amount of gas and increasing the internal pressure inside of a waste storage tank.
- ___ 9. The heat jacket could not handle the amount of heat produced by the production process.
- ___ 10. A ladder was used as a platform during "Hot Work" operation.

IV. INDUSTRIAL ACCIDENTS (28 points)

Read the following articles below and answer the following questions?

1. Article 1: (20 Points)

Fire, explosion at Bangchak refinery

Bangchak Petroleum has shut down its oil refinery in Bangkok's Sukhumvit Soi 64 for a week and an 80,000 barrel-per-day crude distillation unit for at least 30 days following a fire and explosion at the plant on Wednesday morning.

It was the second fire at the soi 64 refinery in 18 months.

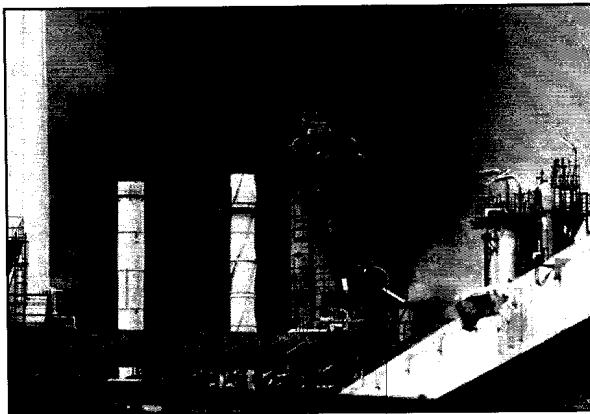
The explosion about 7.30am (on Wednesday, July 4, 2012) in an industrial zone in inner Bangkok surrounded by residential areas set off towering flames and sent two columns of thick black smoke into the sky that could be seen across the capital.

It is the second, recent such accident at refinery. A fire in January last year was believed to have been caused by an oxygen pipe leak.

Bangchak Petroleum Plc president Anusorn Sangnimnuan said total damage was estimated at up to 100 million baht.

It was covered by insurance and would not hurt revenue, Mr Anusorn said.

He said other units at the 120,000 barrel-a-day facility were not damaged and will be restarted in a week's time.



The site also has a 40,000 barrel-a-day crude unit and a hydrocracking plant with a capacity of 25,000 barrels a day, he said.

Mr Anusorn said the company "still has confidence in the safety system and will continue using the Bangkok refinery".

Fuel sales in Bangkok will not be disrupted because the company has a stock of three billion litres that would last for two months, he added.

The plant was handling 110,000 barrels a day before the fire, according to Krit Vinijorn, a company investor relations official. The refinery was closed from May 25 to June 23 for annual maintenance, he said.

Industry Minister Pongsvas Svasti said there might have been a leak in a gas pipeline and this could have been the source of the explosion and fire.

MR Pongsvas said the situation had been brought quickly under control. People in nearby communities did not panic and they had not been evacuated, he said.

The 80,000 barrel-per-day crude distillation unit will be closed for at least 30 days for inspection, the minister said.

"What we need to do now is to assess the environmental impact, such as the amount of sulphur dioxide emitted and its effect on people's respiratory systems. The Natural Resources and Environment Ministry will look into these issues," MR Pongsvas said.

He said the Department of Industrial Works was responsible for inspecting the safety measures in place to prevent a similar incident from happening again.

He was relieved that emergency units were able to promptly bring the situation under control and that the warning system was fully functional.

3.1 What possibly caused the accident? (2 points)

3.2 When, where and what type of accident took place? How many accidents occurred at this plant over the last 18 months? (6 points)

3.3 What is the estimated cost of the damage? What is current capacity of the refinery (How much was it processing per day)? How much reserve (stock) does the company have? (3 points)

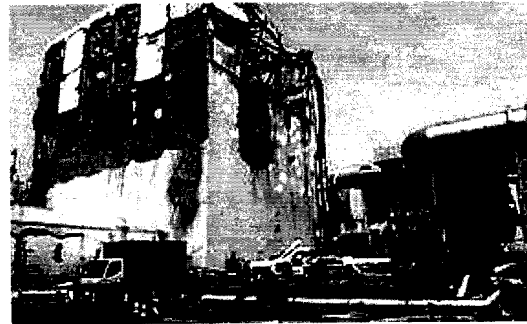
3.4 What is the capacity of the refinery unit that is being shut down? How long will it be shut down? How long will the entire plant be shut down? Why is it being shut down?
(5 points)

3.5 Which government agency will be investigating the environmental impact of this accident? What chemical compounds will they be checking for? What is the effect of this compound on human? What is the responsibility of the Department of Industrial Work after the accident? **(4 points)**

Article 2: (8 Points)

Japan nuclear plant 'safe' by January

PHOTO Water is sprayed onto the spent fuel pool of Unit 4 at the Fukushima Daiichi Nuclear Power Station in March. [TEPCO]



Efforts to stabilise the worst nuclear crisis since Chernobyl 25 years ago have continued since a 9.0 magnitude earthquake triggered a tsunami on March 11, sparking reactor meltdowns at the plant and spewing radiation into the environment.

Challenges ahead

The government said radiation levels around the plant, which lies 220 kilometres (136 miles) from Tokyo, had fallen to "two-millionth" of the peak recorded March 15. Tens of thousands of people remain evacuated from homes, businesses and farms in a 20 kilometre no-go zone around the plant. Amid criticism it has done little to safeguard local residents from radiation risks, the government pledged to earmark 78.2 billion yen (\$US990 million) for a health program to monitor radiation exposure of all Fukushima residents.

Renewed food safety worries have emerged after contaminated beef was found to have been shipped around the country and probably eaten, prompting Japan to announce a ban on Fukushima beef cattle shipments.

3.6 What caused the nuclear meltdown and when did it occur? (2 points)

3.7 When and where was the last major nuclear meltdown (crisis)? (2 points)

3.8 What is the current radiation level? How far is this nuclear reactor from Tokyo (2 points)

3.9 What is the name of third nuclear power point? What was the new food safety concern? (2 points)

V. FIRE PREVENTION TRAINING (35 points)

1. Name 4 basic ways to prevent a fire in home and office. **(4 points)**

2. Name 4 ways of extinguishing a fire. **(4 points)**

3. Name 5 common causes of fire. **(5 points)**

4. Name 5 ways of preparation for fire. **(5 points)**

VI. DISCUSSIONS (30 points)

1. Using the attached diagram of a typical R&D facility layout (Fig.1), write where the following should be located: the service vehicles, the parking space for the employees and visitors, the office area, the workshops, store area, low hazards materials, high hazards materials, laboratory, control equipment, high hazard experimental area, and restricted area. **(10 points)**

2. Name 10 types of hazards that are found in our Chemical Engineering Department. Give specific examples of each (i.e. the slippery, greasy floor of the vacuum frying unit is a hazard). An example cannot be used more than once. Also give one way to prevent each hazard from occurring. **(20 points)**

BONUS: (8 Points)

1. What is N'Brave's favorite Transformer character? (2 points)

- (a) Optimus Prime
- (b) Bumblebee
- (c) Iron Hide
- (d) Sam

2. Where is N'Bright going to school now? (2 points)

- (a) Na School (Anubarn Nakorn Hat Yai)
- (b) Worapat School
- (c) Saengthong Vittaya School
- (d) Boonlert School

3. How much water/water vapor pressure is required to put out the following type of fire? (3 points)

- (a) Electrical/electricity fire –
- (b) Metals/chemicals fire –

4. Where was the picture below taken? (2 points)

Answer: _____



CONGRATULATIONS! END OF EXAM!

Designing R&D Facilities

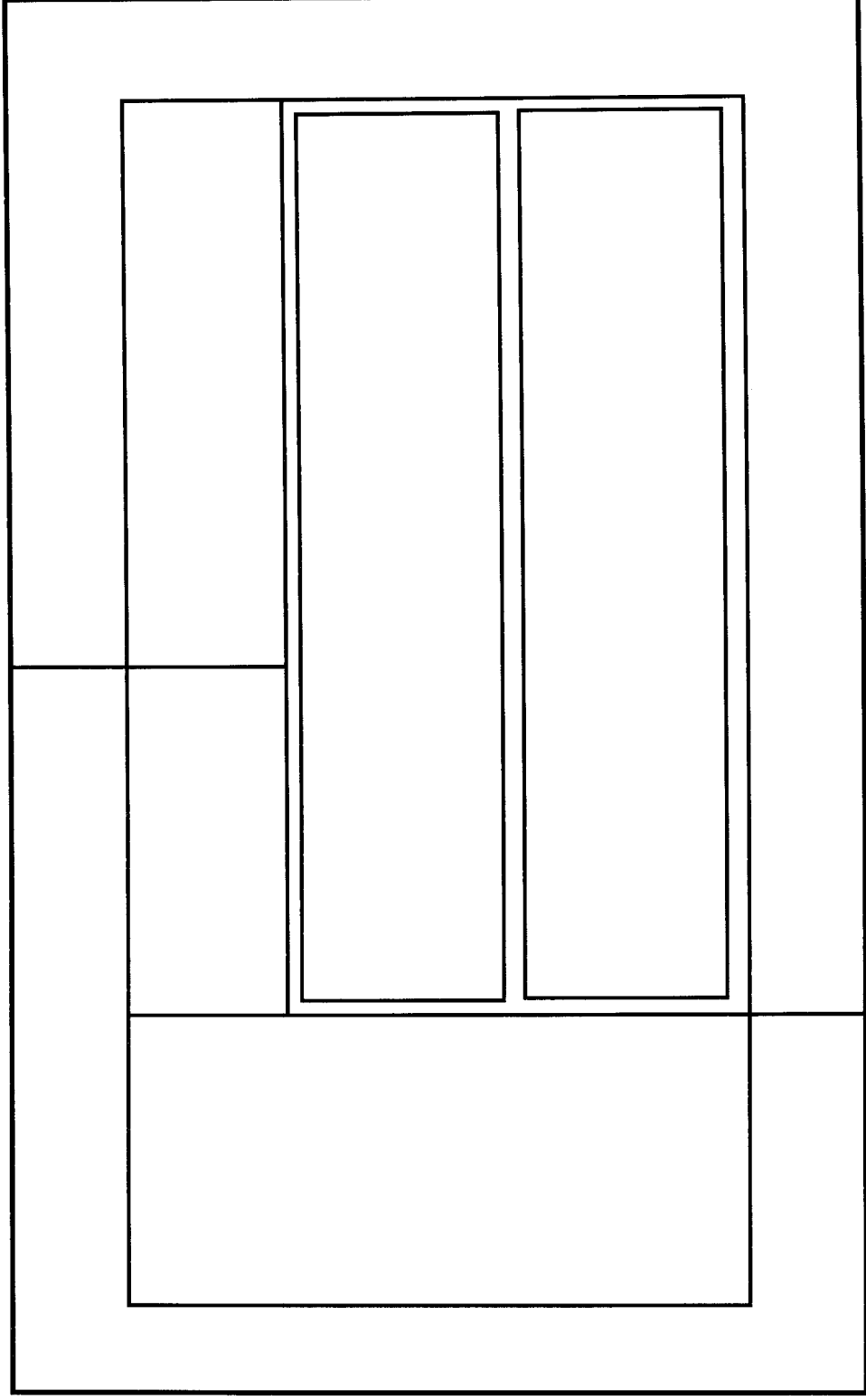


Fig. 1: Typical R&D facility layout