# Meaning of engineering disaster

The duty of the engineer is to react to people need by building or creating something along an appropriate set of guidelines. Importantly, that device, plan or creation should perform its function without any failure. Everything, nonetheless, must eventually fail to perform its given function with a sought after level of performance. Hence, the engineer must struggle to design in such a way as to avoid failure which could result in loss of property, damage to the environment of the user of that technology, and possibly injury or loss of life. Through analysis and study of engineering disasters, modern engineering designers can learn what not to do and how to create designs with less of a chance of failure. (Leveson, 1993)

## The history of Chernobyl nuclear power plant

Chernobyl is a small town in the Ukraine near the Belarus border, with a population of 45, 000. The nuclear power station of Chernobyl lies 15 kilometers to the northwest of the actual Chernobyl town.

In 1986, the USSR generated roughly 10% of the world’s nuclear power from only 43 operating reactors. Together they produced 27 thousand Mega Watts of electricity. By 1986, the year of the accident, four of the reactors at the Chernobyl nuclear power station were the most modern to date Soviet reactors, the RBMK-type. Two more of these reactors were still under construction at the station.

(http://library. thinkquest. org/3426/data/introduction/location. html)

## Aim of this topic

This research can be roughly divided into three parts as follows. Firstly, a variety of opinions and different perspectives of the survey would be

discussed. Then, a discussion will include the information from other related sources and analyze the survey together. Finally, a conclusion will be drawn concerning the findings of the research project; recommendations will be made with regards to future research into the issue, and limitation on this report.

# Literature review

# Overview of engineering disaster

# The failure into an engineering disaster

There are many factors that can cause engineering disaster and much of the reason why we consider an engineering failure to be an engineering " disaster" has to do with public perception of risk. " For example, in 1992 roughly the same number of fatalities occurred (in the United States) in transportation accidents involving airplanes (775), trains (755), and bicycles (722). Yet the public perception of the risk associated with air travel is often much higher than that for trains and certainly for bicycles." (Matousek, 1976) This stems from two reasons: (1) the large loss of life resulting from a single air crash, and (2) the air passenger's lack of control over their environment in the case of air or, to a lesser degree, rail accidents. Both of these reasons results in increased fear, and hence a higher degree of perceived risk.

# Principle cause of engineering disaster

The primary causes of engineering disasters are usually considered to be

Design error

Standard of the plant (depending on cost)

Operating error

Human lack of knowledge and skill

1. 2. 3 Mechanical error

Management tools (Preventive maintenance)

(Bernhard, 1999)

## How Nuclear Physics works

## Nuclear Fission

Nuclear fission is the process whereby large, unstable atoms are ‘ split up’ and as a result release large amounts of energy. The most common element used for this process is called uranium.

## Process of nuclear reactors

Nuclear fission reactions occur inside the core, producing heat. The control rods control the system by absorbing stray neutrons which in turn slows down the rate of reactions.

The heat from the core is transferred to the water through conduction, which then turns into steam with a temperature of 580°C.

The pressure of the steam turns the turbine, powering the generator.

The generator converts the turning motion of the turbine into electrical energy, which now can be injected into the national electricity grid.

This steam is then cooled by water from the cooling lake which then causes the steam to condense back into water. The cycle then repeats. (Ben, 2008)

## Pros and cons of Nuclear power plant

These days, there are a great number of alternative energy that human found and nuclear energy is one of the best choice of alternative energy.

On the plus side, there are many benefits of nuclear power. To begin with, it is a clean energy; therefore, it would dramatically improve the environment. For example, smoke and carbon are not contributing to greenhouse effect and consequently protect the ozone. Furthermore, nuclear power is reliable because it is use only a little uranium to make nuclear reaction which cause a great number of energy.

On the other hand, nuclear technology is problematic in some ways. One of the main drawbacks of nuclear energy is that radiation can harm cells of human body; hence, it can make humans sick or even cause death, and symptom illness can affect and kill people in follow years.

## Dangers of radiation

When unstable atoms naturally break down (decay) they release they release radioactive particles. There are three types of particles: alpha Î±, beta Î² and gamma Î³. They are considered dangerous as they are able to ionise. They are able to change the stucture of atoms by knocking off or dragging electrons away from the atom. In humans, animals and plants, this ionising effect alters the DNA code in cells causing cell mutation. Through this, the altered cells are reproduced through cell division which may then form cancerous growthsThis radiation isn’t only sourced from the site of a nuclear disaster. Poising can occur through contaminated water which then

infects soil and hence food supplies. To add more to this potential problem, radioactive particles can stay hazardous for thousands of years. (Ben, 2008)

## The Chernobyl nuclear power plant disaster

## The Accident

The accident at the Chernobyl nuclear reactor that occurred on 26 April 1986 was the most serious accident ever to occur in the nuclear power industry. The reactor was destroyed in the accident and considerable amounts of radioactive material were released to the environment. The accident caused the deaths, within a few weeks, of 30 workers and radiation injuries to over a hundred others. In response, the authorities immediately evacuated, in 1986, about 116, 000 people from areas surrounding the reactor and subsequently relocated, after 1986, about 220, 000 people from Belarus, the Russian Federation and Ukraine. The accident caused serious social and psychological disruption in the lives of those affected and vast economic losses over the entire region. Large areas of the three countries were contaminated with radioactive elements, and radionuclides were measurable in all countries of the northern hemisphere. (Alexander, 1993)

## The Cause of the disaster

There are several factors which cause Chernobyl nuclear power disaster.

1. Human error (Operator Over-Confidence)

– The operators felt they were an elite crew and they had become overconfident

– The operators did not think carefully enough about the effects on the reactor.

– The operators felt under pressure to complete the test this time.

2. Design error (Safety System Inadequacies)

– A fault in the control system also makes the emergency shutdown unable to function.

– The emergency shutdown desired effect relied on the reactor being operated correctly.

– There had to be at least 30 control rods in the core for the emergency shutdown to work to according to standard.

– The reactor could not be run at low power normally.

(http://library. thinkquest. org/3426/)

## The Affected by the disaster

One major result of the Chernobyl accident that would cause as much agony to the incident was the spread of radiation. A definite effect of the spread of the radiation was the damage it had on the Eastern European agriculture. The EC (European Community) immediately put a 90 day ban on agricultural goods from Eastern Europe. This was initially thought of as political strategy from the US as well as other Western countries. This caused the Soviet Union to take the responsibility to pay for all the damage done to the Eastern European agriculture.

# Post-Disaster

## The effects on health

Chernobyl affected the health of many people throughout Russia. Altogether the total number of fatalities caused by Chernobyl stands at 31 officially. Around 600, 000 however were classified as being “ significantly exposed” and will have their health monitored their whole lives. Twenty-four people were disabled by the accident; some so severely they were left as invalids for the rest of their lives. Two-hundred thiry-eight people have suffered acute radiation syndrome. The total number of people that were in this classification is somewhere around 10, 000. The official report on the number of cancer effects is as follows as prescribed by the International Nuclear Safety Advisory Group (INSAG) of the IAEA. (Vladimir, 1991)

## Environmental impact

Besides the effects on humans, the Chernobyl disaster also dramatically affected the environment with 150 000 km2 of land contaminated with radioactive material. Mutations in both plants and animals were evident – Leaves changed shape and some animals were born with deformities. Despite this, rare species of moose, birds, beavers, wolves and boars have returned in the absence of humans. (Vladimir, 1991)