CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

This chapter will briefly explain about the introduction of this project. The introduction must be clear before run any project. This chapter will consist of project background, problem statement, objectives and scope of study. All this information is important before furthering to the analysis and study later.

1.2 PROJECT BACKGROUND

A pipe is a tubular section or hollow cylinder usually not necessarily of circular cross-section. Hydrogen is used mainly to convey substances which can flow liquids and gases (fluids), slurries, powders, masses of small solids. It can also be used for structural applications; hollow pipe is far stiffer per unit weight than solid members.

In common usage the words pipe and tube are usually interchangeable, but in industry and engineering, the terms are uniquely defined. Depending on the applicable standard to which it is manufactured, pipe is generally specified by a nominal diameter with a constant outside diameter (OD) and a schedule that defines the thickness. Tube is most often specified by the OD and wall thickness, but may be specified by any two of OD, inside diameter (ID), and wall thickness. Pipe is generally manufactured to one of several international and national industrial standards. While similar standards exist for specific industry application tubing, tube is often made to custom sizes and a broader range of diameters and tolerances. Many industrial and government standards exist for the production of pipe and tubing (González, 2008).

The term fuel gases are referring to Natural Gas (NG) and Liquefied Petroleum Gas (LPG). In Malaysia, NG is transported through the transmission and distribution system pipelines to the consumers. While LPG, a mixture of propane and butane gas which is derive from oil and gas through the gas processing plants and oil refineries, is bottled before arriving at consumers' premises. In Peninsular Malaysia, NG is only supplied from the Gas Processing Plant (GPP) in Kerteh. However LPG is supplied from various sources. The sources of LPG used in Peninsular Malaysia are derived from GPP in Kerteh, PETRONAS Refinery in Kerteh, Gas Processing Plant near Sri Rancain Thailand, Esso Refinery in Port Dickson, Shell Refinery in Port Dickson, PETRONAS Refinery in Melaka and Refinery in Singapore. Whether NG or LPG, to transporting it to the final users it require pipelines (Bai et al., 2010).

There are various alternatives to the type of material used for these pipes which are installed within the consumers' premises. However, it is important to note that, only materials that conform to Malaysian Standards and appropriate International Standards are recommended to be used as a piping material. The used of copper tubes has been established in a wide variety of environments as well as for the installations of all types, including hot and cold water system, drainage and venting, heating, air conditioning and refrigeration. Nowadays, copper can compete with other materials for installation of gas system due to its advantages hence adding the choices available to the customers (Cheng, 2007).

Hydrogen induced laminations in sour gas pipelines usually appear in a stepwise form inside the wall of the pipe. These defects can be originated among other causes due to the hydrogen absorption. When two laminations in the same plane interconnect, then a crack of greater size is formed without forming a step, but if the cracks form in different planes, the step is formed. According to previous studies, this is the weakening step in the failure mechanism of a laminated plate under tension. Hydrogen induced cracking (HIC) crack is the increment of the internal pressure in the lamination, which leads to the interaction of the stress fields in the proximity of the crack tips, thus forming a plastic zone that fails by shear. This is called "pressure mechanism". A finite element analysis of two overlapped non-coplanar cracks studied the interaction of two parallel semielliptical surface cracks under tension (Hirth, 1980).

1.3 PROBLEM STATEMENT

Hydrogen sulfide gas is also known as “sewer gas” because it is often produced by the breakdown of waste material. At low levels, hydrogen sulfide gas has a strong odor similar to rotten eggs. Hydrogen sulfide gas occurs naturally in crude petroleum, natural gas, volcanic gases and hot springs. Hydrogen sulfide is colorless, flammable gas under normal conditions. It is commonly known as hydro sulfuric acid, stink damp and sewer gas. Hydrogen Sulfide is a naturally occurring gas mixed with natural gas or dissolved in the oil or brine and released upon exposure to atmospheric conditions (Michigan, 2001).

In general with high strength and stainless steels sulfide stress corrosion cracking (SSCC) has been recognized as a serious problem for the petroleum and petrochemical industries. Also similar failures have been reported in medium strength micro alloyed pipeline steels. Commonly, the sour environments contain amounts of salt water, hydrogen sulfide (H_2S), and carbon dioxide. Upon its composition and temperature, this environments, may cause general corrosion, localized corrosion, and stress corrosion cracking in the materials used. A variety of variables contributed to develop SSCC in iron base alloys (Gomez, 2003).

1.4 OBJECTIVES

For this project, two main objectives are listed:

i. To study the interaction of two non-coplanar cracks.
ii. To analyze the maximum stress for various crack size and pressure on defect.

1.5 SCOPE OF STUDY

This study was focus on two cracks interaction in a pipeline. The step consists of:

a) Material used is API X65.
b) Software MSC Marc 2008 r1 used to simulate the cracks.
c) This simulation will consist of plastic and elastic deformation.