CHAPTER ONE

INTRODUCTION

1-1: Preface

Vessels, tanks, and pipelines that carry, store, or receive fluids are called pressure vessels. A pressure vessel is defined as a container with a pressure differential between inside and outside. The inside pressure is usually higher than the outside, except for some isolated situations. The fluid inside the vessel may undergo a change in state as in the case of steam boilers, or may combine with other reagents as in the case of a chemical reactor. Pressure vessels often have a combination of high pressures together with high temperatures, and in some cases flammable fluids or highly radioactive materials. Because of such hazards it is imperative that the design be such that no leakage can occur. In addition these vessels have to be designed carefully to cope with the operating temperature and pressure. It should be borne in mind that the rupture of a pressure vessel has a potential to cause extensive physical injury and property damage. Plant safety and integrity are of fundamental concern in pressure vessel design and these of course depend on the adequacy of design codes. When discussing pressure vessels we must also consider tanks. Pressure vessels and tanks are significantly different in both design and construction: tanks, unlike pressure vessels, are limited to atmospheric pressure; and pressure vessels often have internals while most tanks do not (and those that do are limited to heating coils or mixers). Pressure vessels are used in a number of industries; for example, the power generation industry for fossil and nuclear power, the

petrochemical industry for storing and processing crude petroleum oil in tank farms as well as storing gasoline in service stations, and the chemical industry (in chemical reactors) to name but a few. Their use has expanded throughout the world. Pressure vessels and tanks are, in fact, essential to the chemical, petroleum, petrochemical and nuclear industries. It is in this class of equipment that the reactions, separations, and storage of raw materials occur. Generally speaking, pressurized equipment is required for a wide range of industrial plant for storage and manufacturing purposes. The size and geometric form of pressure vessels vary greatly from the large cylindrical vessels used for high-pressure gas storage to the small size used as hydraulic units for aircraft. Some are buried in the ground or deep in the ocean, but most are positioned on ground or supported in platforms.

1-2: Problem Statement

High requests are placed on Sudanese companies working in the field of pipeline and petroleum equipment, regarding design and manufacturing of pressure vessel.

The national experience in this field is very limited. also According to ASME and internationally adopted other design codes, pressure vessels are made of alloy steel, but alloy steel in Sudan is not available. This research is an attempt to explore this field to know whether commonly used mild steel in an adequate alternative.

1-3: Objectives

The objective of this research is to design a liquefied Petroleum Gas pressure vessel made of St 37-2 (Miled steel) in order to verify the possibility of using this steel type as a fabrication material of pressure vessel, then analyse the resulting design using ANSYS package in order to assess the design for strength.

ANSYS gives more insight regarding stress at the bends (areas where the shell meets the dish end) where no analytical formulas can be used.

1-4: Research Methodology

- a- Theoretical study regarding the internationally adopted code.
- b- Application study on vessel design.
- c- Analysis the design obtained in (b) using some computer package such as ANSYS.