

CHAPTER 1

Introduction

Volatile organic compounds (VOCs) are among the most common air pollutants emitted by chemical process industries, and include hydrocarbons such as olefins, paraffins and aromatics. VOCs adversely affect air quality as it is one of the precursors of groundlevel ozone (GLO), the primary component of smog. It can also have a negative impact on human health due to its toxicity. During petrol storage and distribution, VOCs are emitted due to evaporation, where the rate of evaporation depends on factors such as the vapour pressure of the liquid, temperature and turbulence.

Vapour recovery of petrol is used extensively in Europe and the United States of America, with legislation to enforce its use. In South Africa little attention has been given to VOC control in general, and the use of vapour recovery systems in particular. There are also no South African legislation regarding the use of vapour recovery systems for the control of VOC emissions originating from petrol storage and distribution systems.

The Engen-Wentworth refinery and loading facility is situated in Durban's South Basin where poor planning has left a legacy of environmental and social problems. A vapour recovery unit (VRU), the first of its kind in South Africa, was installed at the Engen bulk storage and loading facility to recover vapour originating from road tanker filling. However, little is known locally about the use of vapour recovery generally, the available technologies, as well as the operational setup at bulk storage facilities.

The objectives of this dissertation are to:

- evaluate vapour recovery systems used in first world countries for the control of VOC emissions from petrol,
- determine evaporative losses from the filling of road tankers at a bulk storage facility, and
- assess South African present and future legislation with regard to VOC emission control.

In this dissertation the evaluation of vapour recovery systems and related terminology was conducted via a literature survey and is presented in Chapter 2. The complete vapour recovery system at the Engen Wentworth bulk storage and loading facility and the methodology for experimental work is set out in Chapter 3, followed by a discussion of the results in Chapter 4. Conclusions and recommendations are presented in Chapter 5.

According to Jeffery (1998), there is some discrepancy in the definition of VOCs used in international legislation. In the United States of America a VOC is defined as any compound of carbon that participates in atmospheric photochemical reactions, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonates and ammonium carbonate. The United Nations Economic Commission for Europe (UNECE) classifies VOCs based on their photochemical ozone creation potential (POCP). POCP is defined as the change in photochemical ozone production due to a change in emission of a particular VOC and can be determined by photochemical model calculations or laboratory experiments (Jeffery, 1998).