2. Dimethylformamide (DMF) Plant

The purpose of the DMF plant is to react dimethylamine (DMA) from the methylamines plant, with carbon monoxide from the Oil Gas Plant, with sodium methoxide catalyst to produce dimethylformamide (DMF) for external sale. The current capacity of the plant is approximately 24,000 tpa.

The DMF plant was built in 1976, originally as a dual-purpose plant, also making Dimethylacetamide (DMAc). The plant currently only produces DMF.

Picture of the DMF reactor plant (May 2004)

2.1. Process Description

DMF is produced by the reaction between liquid DMA and gaseous carbon monoxide (CO) in the presence of sodium methoxide in methanol as a catalyst:

The reaction is exothermic, but reversible, and so is carried out in the liquid phase at high pressure, with the gaseous carbon monoxide injected into the recirculating product stream. The liquid DMA, the gaseous carbon monoxide and the liquid catalyst are injected in to the reactor base, with a slight excess of carbon monoxide. The carbon monoxide stream also contains hydrogen (H_2), which passes through the reactor unchanged. The catalyst reacts with by-products in the gaseous feed stream, such as carbon dioxide and water, to form solid salts, which settle out in the reactor, in particular on the cooling coils. These salts are water soluble, so periodically, when

the salt deposits build up and affect the cooling capacity, the reactor has to be taken off line and washed out.

Prior to the reaction the carbon monoxide / hydrogen stream, which is fed directly from the gas compressor on Oil Gas plant (not detailed here) is purified to remove as much water and carbon dioxide as possible to reduce the by-product formation in the reactor. The DMA is pumped directly from the liquid DMA storage tank on the Methylamines Plant. The sodium methoxide in methanol catalyst is imported in road tankers to a local storage tank, and then pumped directly into the reactor.

The reactor operates as a pumped circulation loop between two vessels, with the pump discharge entering the reactor base with the carbon monoxide injected into it. Flow occurs from the reactor to the circulation drum, which acts as a gas disengagement vessel from which unreacted hydrogen, with a small amount of carbon monoxide, is vented off, and which also provides the suction for the circulation pump. There is also an overflow pot into which a continuous stream of DMF product flows, and is discharged to the crude DMF tanks.

Crude DMF is doped with water to prevent further reaction, any salts are allowed to settle out, and then the liquid phase is fed to an evaporator, which vaporises the DMF. This vapour is fed to the light ends column, where methanol, water and any residual trace DMA are removed. The bottoms stream from the light ends column is pumped into the product column, and the refined DMF taken off as an overhead stream to the rundown tanks, and analysed. In specification product is moved to the product storage tanks for subsequent export.