KEY INTERNATIONAL AND LOCAL STANDARDS, GUIDELINES AND CODES OF PRACTICE FOR THE DESIGN AND CONSTRUCTION OF PAFF

1. The tanks at the proposed PAFF are designed and will be constructed to American Petroleum Institute (API) Standard 650 – "Welded Steel Tanks for Oil Storage". This standard is currently in its tenth edition, dated November 1998, with addenda in January 2000, November 2001 and September 2003. The materials specified in API 650 have been chosen and are tested to avoid properties that lead to brittle fracture. The specification for the steel grades ensures that problems experienced historically in the fabrication of tanks are avoided. Plates are tested for chemical composition and mechanical properties to show that they can meet or exceed the specification requirements which include any propensity to brittle fracture.

2. The welding procedures specified in API 650 are designed to ensure that there are no out of tolerance defects in the weld, such as voids, inclusions, lack of fusion of the welded metal with the metal being joined or cracks. No weld is to be performed upon the tank unless it is to a specified welding procedure. Welds are non destructively tested in accordance with API 650 to confirm that the welds produced are sound. The welder qualification tests include testing of welded joints undertaken by the welder to show that the welds meet or exceed the specified requirements, which include any propensity to brittle fracture. All welding personnel are required to be qualified and to demonstrate that they can weld satisfactorily to the relevant welding procedure.

3. The PAFF tanks are designed and will be constructed with proven effective coating systems which will protect the tanks against corrosion. In addition, an allowance is made for corrosion in the selection of the thickness of the shell (wall) and floor plates. The tanks will be emptied, cleaned and inspected regularly in accordance with API Standard 653 – "Tank Inspection, Repair, Alteration and Reconstruction: and the Guidelines for Aviation Fuel Quality Control and Operating Procedures for Joint Airport Operation to confirm the integrity of the tank and of the internal coating. Typically, an initial inspection takes place one year after commissioning and then regular inspections are undertaken every three years and a full detailed inspection is performed every ten years. The ten-year inspection will detect, by way of ultrasonic or other suitable non destructive techniques, whether there has been any thinning of the floor plates. Further, floor leakage would be detected at an early stage as there is a leakage detection system incorporated into the tank base.

4. The PAFF tanks will also be designed and constructed in accordance with API Recommended Practice 2003 (Sixth Edition published in 1998) – "Protection Against Ignitions Arising Out of Static, Lightning and Stray Currents". Additionally, the tanks are of closed cone roof design and are far less susceptible to a lightning initiated fire than the floating roof tanks that feature so prominently in the literature concerning tank fires. Ship discharge to the tank farm will cease during thunderstorms to further reduce the potential for the production of vapour at the tank roof vents.

5. The primary fire fighting available to the PAFF includes the provision of base foam injection to a tank on fire. To prevent escalation to nearby tanks, water cooling is also provided to the shell and roofs of adjacent tanks and to the outer surface of the tank on fire. The application rates for foam and water are in accordance with the Institute of Petroleum Part 19 Model Code of Practice in the Petroleum Industry Fire Precautions at Petroleum Refineries and Bulk Storage Installations. Unlimited cooling water is available to the pumps from the sea inlets at the PAFF. The system includes back up pumps and standby generators, sufficient to run the fire pumps, in case of a power failure.

6. Further backup of the fixed fire fighting system will be available at the PAFF because the Fire Services Department (FSD) fire boat will be able to pump water into the system. The emergency vehicle access around the tanks will also allow the FSD the option of applying foam or cooling water directly to the tank tops or bund if necessary. In addition, there will be a number of strategically placed foam "monitors" capable of covering the whole bunded area with foam, to fight any fire within the bunded area.

7. The PAFF tanks designed to API 650 would relieve vapours in the event of a fire or explosion within the tank, along the roof to shell (wall) connection, which is frangible. Breaking of this connection relieves any overpressure build up to ensure the integrity of the tank shell is maintained and the Jet A-1 aviation fuel retained.

8. The foundation of the PAFF tanks is designed in accordance with API 650. API 650 requires all environmental factors to be considered such as ground conditions, weather including wind conditions and potential for earthquakes. There is a significant factor of safety designed into the plate forming the shell of the tank, which is therefore working well within its tensile strength. Each tank will be filled with water and hydrostatically tested over a period of weeks to monitor the settlement of the foundations and to confirm the structural integrity of the tank. To ensure the integrity of the foundation of the tanks (and of the tanks themselves), API 650 requires a hydrostatic test to be undertaken before first use. Under this test the tank is filled to the highest design level with water and settlement is monitored. As water has a higher density than Jet A-1 aviation fuel, the hydrostatic test ensures the tank is tested to a higher load, by about 19% more than the maximum operating load of the tank. Plates of the tank are staggered so that a single continuous line of welding from top to bottom does not occur. Historically, such joints have been found more likely to fail than the plate itself. Hence a staggered plate arrangement assists in arresting crack propagation.

9. The design of the PAFF tanks complies with the principal code of practice entitled "Code of Practice for Oil Storage Installations" issued by the Building Authority in Hong Kong. With regard to the storage capacity of the bund area, the PAFF facility complies with the IP Code of Safe Practice Part 19: "First Precautions at Petroleum refineries and Bulk Storage Installations". Each group of 6 storage tanks are encircled by a concrete bund with a capacity greatly in excess of 110% of the largest tank in the group and the floor is lined with an impervious membrane to ensure that any fuel spill within the bunded area is retained and does not contaminate the surrounding area.

10. The Aviation fuel pumps are designed to American Petroleum Institute Standard 610 – Centrifugal Pumps for Petroleum. Heavy Duty Chemical and Gas Industry Services – Eighth Edition (API 610) and the pipe work is designed to the American Society of Mechanical Engineers Code for Pressure Piping B31.3-2002 (ASME B31.3), equipment designed to these standards incorporate details to minimize the risk of leakage. Notwithstanding the presence of any inherent design features of the pumps and pipe work the aviation fuel pumps are situated within a bunded area capable of holding a quantity of Jet A-1 aviation fuel up to 2,300 m^3.

11. The facility includes a twin berth island jetty designed to meet the requirements of the Hong Kong Port Works Manual and British Standard 6349 supplemented with the Oil Companies International Marine Forum (OCIMF) Mooring Guidelines. The pipe work on the jetty is designed to the requirements of ASME B31.3. A separate assessment has been conducted to establish the alignment and position of the jetty in relation to the existing Urmston Road shipping channel.

12. The jetty, tank farm and existing facility are connected by a submarine pipe line system designed to the requirements of ASME B31.4 Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia and Alcohols.