3 DESCRIPTION OF PROJECT AND ASSUMPTIONS

3.1 Background

3.1.1 It is proposed that the PAFF will be located at an undeveloped reclaimed shoreline site at Tuen Mun Area 38. It will consist of the following major elements:

- a jetty with two berths, which together will accommodate a full range of vessels from 10,000 to 80,000 dwt vessels;
- a tank farm with gross aviation fuel tankage capacity of 264,000m^3 on commissioning and an ultimate tankage of about 388,000m^3 as well as pumps and associated facilities;
- on site operational facilities including offices;
- 500mm diameter twin subsea pipelines to transfer the fuel to the aviation fuel system at the airport.

3.1.2 The planning, design and construction of the project is programmed to take in the region of 3-4 years total, with the commissioning date estimated to be in 2009. The PAFF facility will be designed and constructed based upon the key latest technology, standards and statutory requirements as summarized in Table 3.1 below and Appendix A00.

Table 3.1 Summary of Key Standards, Guidelines and Codes of Practice for PAFF Design and Construction

Facility	Code
Tank	API* 650 "Welded Steel Tanks for Oil Storage"
	API 653 "Tank Inspection, Repair, Alteration and Reconstruction"
	API 610 "Centrifugal Pumps for Petroleum"
	API Recommended Practice 2003 "Protection Against Ignitions Arising Out of Static, Lighting and Stray Currents"
	Institute of Petroleum Part 19 Model Code of Practice "Petroleum Industry Fire Precautions at Petroleum Refineries and Bulk Storage Installations".
	Hong Kong Code of Practice for Oil Storage Installations
	(International) Guidelines for Aviation Fuel Quality Control and Operating Procedure for Joint Airport Operation
Jetty	Hong Kong Port Works Manual
	British Standard 6349
	Oil Companies International Marine Forum (OCIMF) Mooring Guidelines
Pipeline	ASME** B31.3
	ASME B31.4 "Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia and Alcohols"

*API = American Petroleum Institute
**ASME = American Society of Mechanical Engineers

3.1.3 The location of the proposed site and the proposed pipeline alignment is provided in Figure 3.1. The details of each of the key elements of the facility are discussed below.

3.2 Tank Farm and Onshore Facilities

3.2.1 About 6.75 ha of land is required to accommodate the aviation fuel tank farm and associated facilities. The proposed site for the tank farm at Tuen Mun Area 38 has been reclaimed by Government and is zoned for special industrial use. The site is situated at Siu Lang Shui just southeast of the Castle Peak Power station and is adjoined on the west by the Shiu Wing Steel Mill and on the south-east by the proposed EcoPark and adjacent to that is land earmarked for industrial use in keeping with the other land uses in the area. Further east is the River Trade Terminal. The allocated plot has a short length of sea frontage of 60m in width which extends inland for about 140m before widening out to a square area of about 217m in length by 278m in width, see Figure 3.2c.

3.2.2 No residential developments are present in the area and the closest substantial development, Melody Garden in Tuen Mun, is at least 3 kilometres from the proposed site. The villages at Lung Kwu Tan are closer at about 2km away but are screened from the site by the Castle Peak topography. However, there is a planned Holiday Camp to the North-East of the site along Lung Man Road which is over 500m away.

3.2.3 It should be noted that the previous EIA study (April 2002) was undertaken based upon the project layout detailed in Figure 3.2a and a tank design capacity of 420,000m^3. However, changes were made to the detailed layout and an application for a variation (Application No. VEP-133/2004) to the then valid Environmental Permit EP-139/2002 was made. However, during the development of the detailed design, FSD placed a restriction on the height of the storage tanks above the emergency access. Thus, in order to comply with FSD's requirement on the tank height (requested in April 2003), the height of the tanks were reduced from 32.0m to 24.7m and the volume of the largest tanks reduced from 39,000m^3 to 35,000m^3. As a result, the ultimate capacity of the facility was reduced to 388,000m^3 from 420,000m^3, resulting in variation to the environmental permit (EP-139/2002/A) which was granted by EPD in February 2004. Details of the revised layout approved by the VEP are provided in Figure 3.2b and details of the improvements made to the tank farm layout are detailed in EP Variation Application No. VEP-133/2004 and summarized in Table 3.2 below. Also, as part of the changes made, and as shown in Figure 3.2b, the whole site has been shifted 10m to the southeast from that proposed in the original EIA of April 2002, to accommodate Lands Department's commitment of a land extension to Shiu Wing Steel Mill.

Table 3.2 Summary of Tank Farm Improvements

Item		Previous EIA Report (April 2002)	Current Design	Improvement / Neutral	Change Initiated By
Dimension					
1	Volume (largest tank)	39,000 cu.m.	35,000 cu.m.	Improvement	FSD

Item		Previous EIA Report (April 2002)	Current Design	Improvement / Neutral	Change Initiated By
2	Tank height (highest) (total)	32.0 m	24.7 m (23m above ground)	Improvement	FSD
3	Distance from tank to bund	10.0 m	10.0 m	Neutral	--
4	Distance from bund to security wall	8.0 m	8.5 m	Improvement	FSD
5	Distance from bund to boundary	16.5 m (minimum)	18.5 m	Improvement	AA
Bunding					
1	Bund with wave wall	None	Included	Improvement	AA
2	Height of bund wall (average)	4.6 m	4.8 m	Improvement	AA
3	Height of inner security wall	2.0 m	2.0 m	Neutral	--
4	Drainage ditch	Included	Included	Neutral	--
5	Earth bund in landscaped area	None	1.5 m high	Improvement	Planning/EP
6	Outer security fence/wall	Open mesh fence	Impervious wall	Improvement	AA

3.2.4 In addition to these changes, the phasing of the tanks has changed with 8 (eight) to be constructed initially as shown in Figure 3.2c. While Figures 3.2b and 3.2c show the current layout for the site and phasing for the construction of the tanks, indicative cross sections between the tanks and the lot boundaries with Shiu Wing Steel and the EcoPark are provided in Figures 3.2d and 3.2e respectively with the location of the cross-sections shown in Figure 3.2c.

3.2.5 The tank farm will initially house 8 storage tanks, 6 tanks of 43.5m diameter by 24.7m in height, one of 41.5m diameter by 24.7m in height and one of 35m diameter by 24.7m in height. The tank heights refer to the total tank height but it should be noted that part of the tank will be positioned in the ground and as such only 23m will protrude above ground level. The tanks provide a storage capacity of between 22,000m^3 to 35,000m^3. It is intended that the tankage capacity would be increased once the initial capacity of 264,000m^3 has been reached around 2025 to 2030. It is intended that the remaining 4 tanks would be built all together between 2025 and 2030 to increase the tankage capacity to the ultimate design tankage capacity of PAFF i.e. 388,000m^3. The heights of 3 of the remaining tanks would be 24.7m, with one tank of 23m and their capacities would vary accordingly between 35,000m^3 and 19,000m^3. When planning for the 4 remaining tanks in the final phase of the development, latest technology, industrial standards and statutory requirements at that time would be used. Also the EIA would be reviewed if appropriate in view of the latest technology, standards and statutory requirements at that time.

3.2.6 The ultimate storage capacity of the PAFF tank farm of 388,000m^3 should be able to meet the long term planning horizon of HKIA. The tank sizing should also maximize the efficiency of the land usage as well as the compliance with all related industry, statutory and operational requirements. Therefore, to meet the ultimate demand of aviation fuel at the airport to 2040 and the HKSAR Government requirement of maintaining at least 11 days reserve on the airport, a maximum storage capacity of about 390,000m^3 was determined to be required for the PAFF. With the limited land area available (about 6.75 hectares), a total number of 12 tanks with tank capacity varying from 19,000m^3 to 35,000m^3 as described above and illustrated in Figure 3.2b and 3.2c was considered to be the optimum.

3.2.7 With respect to the number of tanks required at the commencement of the PAFF operation, consideration has been given to the demand of aviation fuel at HKIA as well as the timing for the phased development. In order to minimize the potential impact to the normal operation of PAFF tank farm, it was decided to limit the development of the PAFF into two phases as any construction activity during operational phase of the tank farm will bring about added risk. While it has been determined that 6 tanks will be required at the time of the PAFF opening in 2009, construction wise, it is considered prudent to construct the extra 2 tanks at the same time to minimize the construction risk to the operational PAFF. If only 6 tanks are built in the first phase, to cope with the demand the development of further tanks will need to commence in about 7 years time which is considered to be too short a period. Alternatively, if 8 tanks are built at the outset, there would be no need for the development of the second phase of 4 tanks until year 2025 or thereafter.

3.2.8 Therefore, it is proposed to have 8 tanks in 2009 and depending on the ultimate demand of aviation fuel, construction the second phase between 2025 and 2030 as required.

3.2.9 The height of the proposed tanks has been reduced from that previously proposed in the April 2002 EIA in compliance with FSD’s specific requirements (Table 3.2), whereas the diameters of most tanks have been increased as a consequence of compliance with FSD’s tank height reduction requirement in order to maintain the designed fuel storage capacity of the tank farm. Each tank will be designed with a fixed cone roof.

3.2.10 The tank farm would be provided with bundwalls and contained drainage. There are 2 main bunds (designed to contain any spills from the tank or tank piping), each containing 6 tanks in future but 4 tanks initially. The height of the bundwalls has also been increased from previous April 2002 EIA in order to improve the retention of any fuel spillage from the tanks within the PAFF boundary. The initial bund containment with 4 tanks in each bund would amount to at least 180% of the volume of the largest tank (well exceeding the required 110%) and ultimately (2040) this would be at least 150% of the volume of the largest tank with 6 tanks in each bund. Each tank is also separated by intermediate bund walls to hold minor spills. There are also 2 emergency shutdown valves on the pipeline inlet to the tank farm from jetty and another 2 on the pipeline outlet of the tank farm to the Airport. These valves are operated via motorized electric actuators. The tank bunds and the pump platform are contained areas and drain to the interceptor via bund drain valves. Other leakage prevention devices include fuel tank high-high level alarm and leak detection system for the pipeline. The storm water drain will also have a remotely operated block valve to contain any oil spill on site.

3.2.11 Other shore based facilities would include office buildings for administrative and security control, leak detection instrumentation, fire fighting and emergency spill equipment, workshops and basic infrastructure including roads, drains, telecommunications, power supply and lighting.

3.3 Berthing Jetty

3.3.1 The PAFF requires the construction of a twin berth jetty. This will be sited approximately 200m offshore with no direct access to shore. The two end to end berths would run approximately parallel to the quay wall and fuel tanker berthing would be provided on the sea facing side. The main activity at the jetty will be unloading of the tankers to the storage tanks in the tank farm. Two unloading arms on one berth and three unloading arms at the other berth will be provided to unload the fuel at each berth. Fuel lines and services will run to shore through submarine pipes and cabling protected by rock armour not protruding above the existing seabed, so as to provide marine access to other facilities adjoining the tank farm. Details of the jetty are provided in Figure 3.2c.

3.3.2 The sea bed level at the site lies between –17 and –18m PD indicating that water depths can reach 19.5-20.5m during the highest high tides. As the berthing jetty would be built on piles, 100 tubular steel piles of diameter 800mm to 1000mm have already been driven into the seabed from 29 November 2005 to 29 March 2006 (with about 59 days for actual pile driving time) using hydraulic hammers. A key consideration in the design and construction was how to mitigate noise.

3.3.3 A particular consideration for this project is the need to protect marine mammals from disturbance during the piling. Similar issues were raised when the temporary AFRF was constructed near Sha Chau in 1995. At that time the Airport Authority were advised by a panel of international cetacean experts that percussively driven piles would be preferred over in-situ bored piles, as was the original intention at that time, based upon the decreased time required for this technique, although it would be important to strive to mitigate noise. (ERM 1996). A similar approach was adopted in the piling of the PAFF but a range of mitigation measures were applied before and during these piling works in accordance with the previous Environmental Permit EP-139/2002/A. The measures applied are discussed in more detail in Section 7.

3.3.4 Two defensive fender piles have already been installed on the on shore side of the jetty to prevent any possible collision from small craft straying into the prohibited area. Coupling points on the ship would be provided with slop trays to catch occasional minor spills of unloaded fuels during coupling and de-coupling and the vessels will deal with the spills.

3.4 Pipeline

3.4.1 A short buried submarine twin pipeline will connect the reception jetty to the onshore tank farm, together with the utilities required for the jetty. The fuel from the jetty to the tank farm will be transferred at a rate of 3,500m^3 per hour. It is proposed that the fuel would then be delivered to the airport site by means of further buried twin subsea pipelines which would connect to the existing facility at Sha Chau. The total length of the pipelines would be about 4.8km including a 400m stretch within the Lung Kwu Chau and Sha Chau Marine Park in the approach to the existing AFRF pipeline.

3.4.2 The twin pipelines would each have an outside diameter of 500mm. The pipelines will be operated at a pressure of 30 barg (gauge pressure) and have a pumping rate of 30,000m^3 per day or 1,500m^3 per hour based upon 20 hours per day of pumping. It is assumed that these would be continuously welded, encased in concrete and lowered into a trench of 3m depth to protect against 6 to 22 tonne anchors. Future dredging activities are planned along the pipeline route for a coal berth for CLP in Urmston Road and, therefore, in this section of the alignment, the pipeline depth will be increased to about 6.5m below seabed. In both cases, the trench would then be backfilled with graded stones and rock armour to protect the pipelines. Schematic illustrations of the proposed pipelines and utilities from the jetty to shore and from the tank farm to the connection with the AFRF at Sha Chau are provided in cross sections (A) and (B) respectively in Figure 3.3.

3.4.3 The pipeline from the PAFF to the existing AFRF would be connected by being brought up one of the existing dolphin piles and flanged together with the existing pipeline using a new valve arrangement incorporated in-between.

3.4.4 The trench is assumed to be formed by a combination of trailer suction hopper dredger for the deeper areas in Urmston Road and by grab dredging for the remaining length. Graded rock would be subsequently placed either down pipe directly into the trench or lowered by grab. The proposed outline construction method for the placing of the rock armor is provided below:

- The submarine pipelines are protected from dragging anchors by layers of large crushed rock up to 700mm in size. The crushed rock will be quarry rock without clay or silt contamination minimising any release of additional sediment load to the surrounding waters;
- It is proposed to use a target barge, hopper barges, and derrick lighters for the backfilling work;
- Position of the target barge will be controlled by DGPS (Differential Global Positioning System). The barge will be held in position with 4 mooring lines;
- The first layer of material over the submarine pipelines will be Grade 200mm bedding layer. This layer of rock will be placed by hopper barge in shallow (less than 10 metres) water depth areas. A derrick lighter will be used for placing the protection layer at section where the water depth exceeds 10metres;
- When the target barge is set to correct position, the hopper barge or derrick lighter will be moored to the target barge and backfill of rock will commence;
- The protection berm will be checked by echo sounding to ensure sufficient rock cover is provided before placement of Grade 700mm rock fill layer in a similar manner;
- A derrick lighter will trim the rock to the required profile, to ensure no rock protrudes above the original seabed level;

- Intermediate surveys by echo and chain soundings will be conducted to verify the rock profile; and.
- On completion of rock dumping work, a hydrographic survey will be carried out to verify the profile of the rock armour complies with the design requirements. A copy of final survey will be transmitted to the Marine Department and the Lands Department for their records.

3.4.5 A possible alternative to dredging a trench for the pipelines would be horizontal directional drilling, tunnel and ploughing. These techniques have been discussed in Section 2 of this report and dismissed on engineering, programming, environmental and cost constraints.

3.5 Tanker Visit Frequency

3.5.1 The fuel reception jetty will provide two berths to allow flexibility to accommodate a full range of vessels within the size range 10,000 to 80,000dwt. Fuel would typically be received at a frequency of three times per week rising to a forecasted average of 3.6 occasions per week at the 2040 planning horizon.

3.5.2 A detailed breakdown of the expected tanker offloading frequency assumptions is provided in Table 3.3 below.

Table 3.3 Tanker Frequency Estimate

Year	Volume in tonnes	Source/ Frequency	No. of vessels	Parcel size	Volume in tonnes	Market share
2010	6,000,000	China	60	20000	1,200,000	20%
		Singapore	64	45000	2,880,000	48%
		Middle East	32	60000	1,920,000	32%
	Total volume				**6,000,000**	100%
	Vessels/ Year		**156**			
	Vessels/ Week		**3.0**			
2040	8,740,000	China	70	30000	2,100,000	24%
		Singapore	80	45000	3,600,000	41%
		Middle East	38	80000	3,040,000	35%
	Total volume				**8,740,000**	100%
	Vessels/ Year		**188**			
	Vessels/ Week		**3.6**			

3.6 Emergency Backup Facilities

3.6.1 In order to ensure the security of fuel supply to the airport, it will be necessary to maintain the existing aviation fuel reception facilities and associated pipeline as an emergency backup following commissioning of the PAFF. This strategic need was recognised at the time that the temporary facility was gazetted. The existing temporary AFRF could not be abandoned because of need to safeguard supply in the event that that the new PAFF ever became damaged or inoperable for whatever reason. This eventuality is considered to be remote but nonetheless must be guarded against given the strategic and economic necessity of guaranteeing constant fuel supply to the airport. For this reason it will continue to be necessary to maintain the dredged access channel and also to maintain the existing pipeline. Based upon the selected pipeline option, regular flushing of the existing pipeline at a frequency of approximately once every 6 weeks to avoid stagnation of the sitting pipe volume and potential contamination of the down stream fuel supply is not required.