CHAPTER 10

RISK ASSESSMENT

10.1 Introduction

As part of the assessment process an evaluation of the risks have been carried out. The project in question deals with the handling of petroleum products and there is a general perception that this may be a dangerous activity. Statistics records have demonstrated such is not the case. Like any other projects risks exist all stages from construction to operation by virtue of the various activities involving hot works, working at heights, conveyance of hydrocarbons, spillages, waste management and controls, health issues and “psychological” disturbances. Therefore such an array of risks could have a significant importance on the project implementation and may require unplanned mitigation.

10.2 Risks during construction phase

The project would comprise the construction of 3 tanks for the storage of HFO of viscosity of up to 380 cSt and Marine Gas Oil 2500 ppm, as well as and the laying of a bi-directional pipeline for conveyance of the petroleum products from the new oil jetty to the proposed project site. The undertaking also comprises the installation of a pipeline connecting the terminal to Quay D for the conveyance of petroleum product for bunkering purposes. The construction of the structures would require care and vigilance by virtue of the tasks involved. The salient features that require particular care and attention are:-

- Working at height
- Hot work and
- Trenching
The construction activity should be under the supervision of an experienced Health and Safety officer. His expert guidance would allow safe work on site.

- **Working at height**

The project will consist of the construction of 3 tanks of height 14m each. The construction of the tanks would be carried by welding steel sheets on a circular steel frame in order to form the tank. The welding of the sheets on the higher parts would require the use of scaffoldings. The scaffoldings consist of galvanised iron tubes placed in a vertical manner to allow workers to reach the required heights. Platforms are created, either by steel decks or wood planks at the desired position. Accidents may arise if the scaffolding is not properly secured. They would tend to sway, overturn or buckle as failure modes. Such collapses may entrain accidents to workers in case they are working on the platforms. To mitigate this risk the scaffold need to be braced horizontally and vertically. This will eliminate sway from lateral movements and buckling under vertical load. Scaffold should not give rise to slenderness conditions in which case failure will occur under lateral torsion buckling. To mitigate this, the scaffold needs to be fixed to the structure at regular interval. The scaffold should be designed by experts and properly supervised by experienced safety officers. Scaffolds need to be regularly checked against defective elements and bracings. Indented or defective elements should not be allowed in erecting the scaffolds.

Due care and attention should be taken at the foot of the scaffold. The stability of the ground and punching effects need to be evaluated prior to erection. A mitigating tool would consist of placing adequately sized metal base plates below the foot of the scaffold. This would provide proper stability and avoid soil punching. The placing of the scaffold should be subject to a design by a professional engineer meeting local regulations approval prior to its erection.
- **Hot work**

The construction of the tanks and pipelines will require welding techniques. Welding of tanks in order to generate the required geometry is a specialised job and should be carried out by experts. The tank would be constructed on site and metal sheet would be welded in longitudinal and transverse direction so as to form the cylindrical
shaped container for the tanks. The construction will proceed in multi-stages upwards starting from ground level.

Hot work may lead to serious impacts if not properly managed. In that respect the labour resources that would be deployed should have sufficient experience in handling the equipment and tools for the job. Moreover the persons involved should be provided with appropriate protective equipment. Works should be carried out under the supervision and guidance of a Safety officer.

Hot work may be source of heat that could create a negative impact on other activities on site. Being exothermic the heat could affect other combustibles that may catch fire or cause an outburst. In that respect it is imperative that during hot work operations the activities that are vulnerable to heat should not be carried out. Other activities could be carried out concurrently provided the workers are not directly affected by the heat, arc light and welding fumes.

Conflicting jobs should be avoided at all times. For example no jobs involving use of water should be carried out near to an activity requiring electric current. Risks of electrocution need to be avoided.

- Trenching works
The conveyance pipelines would have to be put in trenches which shall have an average depth exceeding 1.0m. There are risks of trench wall collapsing and this may damage the pipelines or cause injury to workers in the trench. In that respect it is vital to have the expert input of soil engineers who will provide information on the soil characteristics. These data will enable the engineers to design the profile of the pipeline in the trench. As a mitigating measure the side walls have to be protected against slips and collapse. Therefore the trenches have to be shored with wooden battens and restrained by struts along its alignment.

The collapse of soil is an instantaneous phenomenon and most of the times there are no warning to failure. Workers deployed for trench works need to be protected against such a phenomenon. It has been reported that trench failure can be disastrous to workers if they do not escape or rescued on time. To mitigate this it is important that all trench works be checked by specialists prior to allow worker to go down in trenches, especially for stretches that is deeper than the workers’ height. It
is recommended that there should be more than one worker in trenches at all times. Vehicular movement should be restricted along trench works.

Trenches should be opened on limited length. Several work frontages can be operated concurrently. For trench work carried near surrounding undertaking, it is recommended that trenches do not remain open after a day's work. In case the trenches have to remain opened for certain specific reasons it is suggested that they need to be covered by metal sheets. An alternative would be to backfill the trench and re-open it the next day.

Moreover the trench alignment has to be properly barricaded by stout and robust structures. Adequate signages and warning tapes meeting local regulations have to be placed in a conspicuous manner.

The work site should be kept tidy through scrupulous observation of good housekeeping practices.

Figure 13 shows the trench details.
Figure 13: Trench detail
10.3 Risks during operation

After construction, the tank farm would become operational with the holding of about 19,685 m³ of fuel oil on a site. The main objective of the project is to provide bunkering fuels to ships.

The conveyance and storage of oil may be perceived as a hazardous undertaking by the general public. Such type of facility already exists in the Port Area at Fort George and the oil retailing companies. Marine Gas Oil 2500ppm is a volatile liquid whilst, HFO is a viscous compound that looks like tar and need to be heated prior to put to any use. From statistical records there are isolated cases of environmental damages from oil terminals and tank farms. Damages occur as a result of oil spilling in the environment.

- **Risks against fire**

Since the project involves the storage of petroleum products which are classed as flammable liquid of category 3 and 4, the possibility of an accidental fire outbreak within the tank farm exist. Besides preventive measures the proponent would cause the installation of a water tank and hydrants that would be used to extinguish any fire propagation. Start of fires could be handled easily by trained staff through the use of fire extinguishers. In addition to that a foam tank installation would provide complementary safeguard against fire outburst.

- **Contingency planning**

The risks of the tank and pipeline failing as a structure are remote. The terminals that exist in the Port Area have been there during pre-independence and their performance have been satisfactory. Mechanical failures in terms of rupture and weld failures have not been recorded so far and the risks are negligible. However, should this arise for some reasons that could be beyond the control of everybody, then the oil would be contained within a reinforced concrete bund wall. The risks of all tanks failing at the same time could be safely ignored unless they are subject to an attack or raid or an earthquake of significant magnitude impacting the locus. This scenario is quite very remote.
Most of the calamities occur in sea. Records from statistical data have demonstrated that spillage of oil is frequent among oil tankers transporting crude oil. These are on receding trend. However, since no sea-based activities would be carried out, spillage of oil is unlikely to arise for the proposed undertaking.

Spillage may occur from leakages at valves and fuel offloading points and these needs to be addressed. In such an event, the Port Master will be notified and he will take the command for the response plan.

Furthermore, the undertaking would involve the use of a fired shell type diesel boiler for the heating of HFO of viscosity 380 cSt. As such there would be a diesel storage tank of 10 tonnes in the premises of Beta Oil Terminal Ltd. The position of the diesel tank is shown in the Site Layout plan provided in ANNEX 8. This diesel storage tank will be located within a containment structure of capacity at least 110% of the volume of the diesel tank in question. Any spillage from the tank would be adequately contained, soaked with sand, properly scrapped and left for natural biodegradation through landfilling.

10.4 Emergency Response Plan

An emergency response plan is essential to reduce the probability of occurrence and consequential effect in the eventuality of an oil spill or fire outbreak. An oil spill contingency plan and a fire response plan should therefore be put in place to mitigate the effects of emergencies and restore the situation to normal conditions at the earliest.

The overall objective of an emergency response plan is to make use of the combined resources at the site and outside services to achieve the following:

I. To localize the emergency and if possible eliminate it;
II. To minimize the effects of the accident on people and property;
III. Effect the rescue and medical treatment of casualties;
IV. Safeguard other people;
V. Evacuate people to safe areas;
VI. Informing and collaborating with statutory authorities;

VII. Initially contain and ultimately bring the incident under control;

VIII. Preserve relevant records and equipment for the subsequent enquiry into the cause and circumstances of the emergency;

IX. Investigating and taking steps to prevent reoccurrence

One of the prime considerations of this project is to ensure the safety of personnel, the tank farm and the environment. The proponent has caused the preparation of a Safety and Operations report for the proposed project. This report is a comprehensive stand-alone document. A summary of the risk assessment are provided below.

10.4.1 Product Handling and Transfer

(a) Identification

The following accessories should be suitably marked for easy identification:

- Product liens and valves
- Tank vents, vent lines
- Vapour locks
- Product heaters and heating lines
- Pumps, valves and lines
- Access hatches

(b) Information that need to be displayed in the control room

- Maximum permissible loading rates for each Product tank
- Loading rate for Static accumulating product
- Product pump capacity and pump manufacturer technical data including pump performance curve for various speed
- Mimic diagram of the product handling system
- PV valve pressure/vacuum settings and Cargo Tank Pressure Sensor Alarm Setting
- Operations Manager’s Standing Orders
- Cargo Tank/ Vent branch valve status board
- Emergency Shutdown procedures

(c) Pre transfer safety briefing

- Product name, quality, MSDS details, pollution category
- Gauging and sampling requirement
- Cargo vapour content hazards
- Skin, eye contact hazard
- Poison, toxic hazard, antidote
- Flash point, extinguishing medium
- PPE level required for safe handling of the product

(d) Personal protection

- Provision for emergency decontamination showers and an eye wash

- Employees engaged in product transfer operation including sampling, tank cleaning, pipeline connection/ disconnection, will wear adequate PPEs as identified during the pre-transfer safety briefing.

- Emergency Reporting requirements and Emergency procedures will be discussed and displayed at relevant locations prior commencing transfer operation

- First aid kits will be kept available in the Control room.

(e) Transfer precaution

Transfer operations will be stopped immediately if any one of the following is noticed:
- Emergency alarm is raised
- Explosion / Fire in the terminal
- Leakage from product pipeline hose or connection
- Lightening in vicinity of the terminal
- Several tanks reaching topping up ullages at same time
- Breaking of mooring lines of vessel or barge
- When there is a heavy or dangerous vapour accumulation at the terminal
- If weather conditions deteriorate
- In case of doubt or it is considered transfer to be dangerous

An emergency procedure manual for necessary action in case of a spill is provided in ANNEX 13.

(f) Record keeping

Record will be kept properly for all transfer operations. As a minimum, the followings would be recorded:

- Time of transfer commencement, completion, stoppages (if any)
- Time of tank change over
- Records of regular rounds taken etc
- Time of any delays in transfer operations and party responsible for the delay.
- Requests for reductions in the transfer rates for topping off or rate reductions by the

Any pollution observed will be recorded and reported to the appropriate authority,

10.4.2 Fire-fighting and emergency response plan

The terminal will operate on a 24 hours basis by experienced technical staffs who are well versed with fire-fighting techniques and skills. The terminal operations will
be carefully monitored from the control room by means of a closed circuit TV. Additionally, shift staffs will continuously patrol the critical areas within the terminal.

A summary of the steps involved in the execution for fire-fighting operation is provided below:

(a) Reporting

Any fire incident should be immediately reported to the Shift Supervisor via manual break glass units and Radio communication.

(b) Situation Evaluation

The Shift Supervisor/Terminal Manager will decide on the alert status of the emergency and whether to initiate emergency transport routine. (The alert scenario is enclosed in ANNEX 14)

(c) Command and Control

The Shift Supervisor shall assume command of fire-fighting operations from the Control room until the arrival of the Terminal Manager/ or his designee or the fire brigade personnel;

(d) Fire Fighting

The Assistant Shift Supervisor, Senior Technicians and Technicians shall be dispatched to emergency scene to conduct fire-fighting operations in accordance with the established action plans. The in-house personnel shall continue to assist the fire brigade in their firefighting and rescue operations. The emergency operations shall be conducted in four phases as described in ANNEX 14.

10.4.3 Oil Spill Response Plan

An extract of the oil spill response plan from the Beta Oil Terminal Safety and Operation review report is enclosed in ANNEX 13.