STOLT LILY INSPECTION REPORT

24 April 2003

Purpose of Visit:

To witness the tank cleaning operations carried out by bulk chemical parcel tankers at the outer anchorage in Port Phillip Bay, in order to determine the impact of the tank gas freeing operations on the Melbourne airshed, with particular reference to tanks which have contained Benzene.

Contacts: Stein Nelsen (Stolt-Nielsen Transportation Group Pty Ltd)

Peter Beekman (Stolt-Nielsen Transportation Group Pty Ltd)

Context:

On 18 Sep 02 EPA Victoria Chairman Mick Bourke sent a letter to the Marstel Consultative Group to respond to a number of issues raised by the group relating to the recently issued Marstel Terminals Coode Island Pty Ltd works approval WA47955. In particular Mr Bourke discussed the activities of bulk chemical parcel tanks at the outer anchorage in Port Phillip Bay.

Mr Bourke stated that EPA was generally satisfied that tank cleaning activities conducted by bulk chemical parcel tanker's within the bay would not impact on human health or the environment. However he stated that EPA would witness such a tank cleaning operation first hand at some stage in the next 6 months. This report was prepared and presented to the Marstel Consultative Group to meet this commitment.

Introduction:

Chemical parcel tankers are required to clean and gas free each of their tanks after the discharge of a parcel of product in order to prevent cross contamination of the product with the next parcel to be carried.

The methodology used to clean each tank is highly variable and changes from product to product depending upon the physical properties of the material carried and its compatibility with the next product to be carried. There is a similar level of variability in the measures that a client will require be put in place to ensure that the parcels of chemicals transported by the ship on their behalf are not contaminated. In almost all cases the measures taken to clean the tanks are extensive enough to allow vessel entry and visual inspection of the inside of the tank.

In the vast majority of cases of tank cleaning and gas freeing is undertaken en route to the next port well outside Victorian Waters and in accordance with the *International Convention for the Prevention of Pollution from Ships*, 1973 (Marpol) due to the fact that Melbourne is mainly an import port.

Occasionally a tanker is required to take on an export cargo from Maribyrnong Number 1 berth into a tank that has just discharged product in Melbourne. In this case the tank cleaning operations may be carried out in Victorian state waters and are controlled under the provisions of the *Environment Protection Act* 1970.

On 4 May 2001 EPA served a Pollution Abatement Notice (PAN) on Melbourne Ports Corporation who are the occupier of Maribyrnong Number 1 Berth. The PAN articulates the regulatory requirements for the operation of the berth and, amongst other things, prevents the emission of potentially hazardous and odorous vapours at Maribyrnong No 1 berth. Consequently if an operator wishes to clean a ship's tanks the vessel must leave the berth and is allowed to clean the tanks at the Outer Anchorage in Port Philip Bay prior to returning to Maribyrnong No1 to load the export cargo. The tank washing are required to be maintained on board the vessel in a slops tank during such an operations.

EPA has collected data from the Victorian Channel Authority regarding the number of tankers visiting the Outer Anchorage after leaving Maribyrnong No 1. In the 12-month period to June 2001, 11 tankers did this, representing about 15% of the total number of tankers visiting Maribyrnong No 1.

1. Discharge of parcels of Paraffin Wax, Benzene, and Crude Benzene

At 15:00 on Wednesday 23 April 03 the MS Stolt Lily a 7,593 dead weight tonne Liberian flagged and Philippino crewed chemical parcel tanker docked at Maribyrnong Number 1 Berth. The Lily was built in 1988 making it one of the older ships in service with Stolt in the Asia Pacific Region.

The ship arrived at the berth fully loaded with Paraffin wax in 2 tanks, Benzene in 3 tanks and Crude Benzene (BTX) in 6 tanks. The ships wing tanks were not in use as the Lily is not a double skinned vessel; accordingly the wing tanks are kept empty to provide the double skin capacity required by Marpol.

All of the chemical parcels on the ship were to be discharged to shore facilities. The discharge took 20 hours and the then empty ship was ready to sail at 11:00 on Thursday 24 Apr 03.

2. Planned tank Cleaning Methodology

It was planned to load the Lily with one parcel of Phenol in tank 3CS, which had previously been in Benzene service, and 2 parcels of Styrene Monomer in tanks 6CP and 6CS, which had previously been in Crude Benzene and Paraffin service respectively. These products were to be loaded from Maribyrnong Number 1 Berth. Accordingly it was necessary to visit the outer anchorage to complete the tank cleaning operation.

The Chief Officer of the Lily intended to clean tank 6CS that had contained paraffin wax tanks first and then move on to the Benzene tanks 3CS and 6CP in accordance with the attached tank-cleaning plan. The ships limited ability to produce hot water prevented the conduct of both these operations in parallel and the Chief viewed the Paraffin cleaning operation to be the more difficult of the two, given that paraffin is a solid at ambient temperature, hence it should be conducted first to limit the potential of the ship being delayed.

The benzene tank cleaning operation was from an atmospheric emissions perspective the most sensitive and hence was the main subject of the visit.

The attached tank-cleaning plan for Benzene shows the cleaning operation beginning with a 2 hour cold sea water wash at 20 – 30 m^3/hr using a high pressure washing machine fitted inside the tank. The wash is designed to flush all liquid benzene from the walls and internal structures of the tank to the sump where it is pumped to a slops tank. This process is followed by a 60°C water wash at the same rate for 1 hour, which is designed to volatilise any remaining benzene. These operations are

followed by a quick clean water rinse of the tank cleaning machines, and steaming of the transfer lines and vent riser.

The wash waters from these operations were retained on the ship and discharged at sea in accordance with the Marpol convention.

After the washing operations were completed a blower machine was planned to be fitted to the tank cleaning access hole. When the ship is underway and at sea the tank access hatch are opened and the blower machine is operated at its maximum capacity of 5000 m^3/hr. This allows the vapour contents of the tank to exit via the large tank access hatch and the concentration of benzene vapour in the tank decreases quickly. Whilst at anchor the practice of opening the tank access hatch is not possible due to the fact that there is insufficient wind to clear the deck of the ship of the vapour emissions, hence causing an occupational health and safety issues for the crew working on the ships deck.

Whilst at anchor the tank access hatches are kept closed and the blower discharges through the pressure safety relief valve (PSV) fitted to the 4" vapour header of the tank. The pressure drop of the PSV severely impedes the rate of discharge of the blower fan so a 4" flexible hose is also lashed to the PSV header discharging vapour ~4 m above the level of the deck. Even with both the 4" flex hose operating in parallel with the PSV the fan is only capable of discharging at between 1000 and 1500 m^3/hr.

The blower is generally run for an hour when it is stopped to allow a test of the vapour contents of the tank with a drager tube. If the vapour contents of the vessel in not below the TLV for the material in the tank then the blower is operated for another hour when the vapour contents of the vessel area tested again. Once vessel entry is possible the suitability of the tank for the next parcel of chemicals is confirmed by a visual inspection of the inside of the vessel.

At this time wash waters remaining in the sump of the tank are bailed out by hand and pumped to the slops tank. In this case tanks 3CS and 6CP were certified to a stripping volume (the volume of liquid left in the tank after the pumps are run dry when the ship is on an even keel) of 47 and 95 L respectively.

When the vessel enters port to receive a new parcel the tanks are again visually inspected in the presence of the clients surveyor to ensure they are of a suitable standard to accept the next parcel of product.

It should be noted that it is theoretically possible for ships to attempt to sail in circles within the area of the outer anchorage in order to provide the airflow across the deck which allows the safe conduct of tank cleaning operations with the tank access hatches open. Such a measure would facilitate the significantly higher rate of air discharge of 5000 m^3/hr compared to that which is necessitate when the hatches are shut of between 1000 and 1500 m^3/hr. Despite this fact it is unlikely that such an operation would be attempted due to the cost of the requirements to have a pilot on board whilst the ship is under way.

Should a ship be required to clean a significant number of tanks it is more likely that they would make the 5 hr trip out of the bay to allow the cleaning of the tanks at a much quicker rate, which is possible at sea. The discharge of wash waters from such an operation still remains under the control of the Marpol convention and within limits the *Environment Protection Act* 1970.

It is important to note that the emissions of vapours at the anchorage are spread over a longer timescale than when compared to those that are conducted at sea resulting in a lower peak concentration.

3. Actual tank Cleaning Methodology

The ship sailed for the outer anchorage just after 11:30 am and anchored just before 12:30 pm at a location in Port Phillip Bay, which was roughly 10.2 km at 350° from the mouth of Kororoit Creek and roughly 7.4 Km at 290° from Point Cook. This location was within the area defined as outer anchorage and the pilot left the vessel at this time.

The outer anchorage is a large area and a chemical parcel tanker conducting tank cleaning operations can be directed by Victorian Channels Authority to anchor anywhere within the anchorage. The anchorage at its closest is within 3.3 km of Point Cook and it extends up to 10.2 km from Point Cook. Similarly the anchorage at it closest is within 6.3 km from Altona beach and it extends up to 13 km from Altona.

Whilst the ship was leaving Maribyrnong Number 1 Berth the crew lined up tank 6CS which had been in Paraffin service, to tank 1C which had also been in Paraffin service and was to be used as a slops tank to hold the wash waters from the cleaning of tanks 6CS, 3CS and 6CP.

It had been planned to begin washing tank 6CS with 90° seawater for 4 hours once the ship cleared the mouth of the Yarra River. The start of the washing operations was to be delayed until the ship cleared the river to avoid drawing muddy water from the Maribyrnong / Yarra Rivers into the tanks.

The washing operations were not started as planned as paraffin wax had solidified in a number of dead spot in the lines between tanks 3CS and 1C. The blockages took almost 10 hours to clear and disrupted the completion of the tank cleaning operation in accordance with the attach tank cleaning plan.

By 17:00 it had become apparent that the Paraffin blockage was going to take a long time to resolve and the Chief split his crew using one to continue to attempt to resolve the Paraffin blockages and using a second to prepare the Benzene tanks 3CS and 6CP for cleaning.

The crew fitted with full breathing apparatus removed the flange on the tank cleaning access hatch in the roof of each tank and fitted a tank washing machine, similar to a high-pressure sprinkler, to each tank. It should be noted that when the tank washing machines are fitted and operational the tank cleaning access hatch is not completely air tight, a spade with a segment cut out of it is fitted covering most of the hatch, however there is the possibility of the emission of some vapours throughout the tank washing operations. A plastic sheet cover is fitted over the access hatch and spade cover to stop hot water spraying out of gap in the spade.

The vapour emissions at this stage of the cleaning process are of such a scale that they are only relevant as an occupational health and safety issue for the crew working on deck. This risk is managed by the use of breathing apparatus and limiting the movement of other crewmembers on deck. The emissions at this stage of the cleaning operation are not significant enough to be considered an environmental issue.

Modern chemical parcel tankers are fitted with permanent tank cleaning machines and as the older vessels are phased out of service vapour emissions at this stage of the tank cleaning process will be eliminated.

Tank 3CS was washed with hot water for 3 hours from 18:30 until 21:30. At this stage a drager tube was taken of the contents of the tanks vapour space of the tank showing the concentration of Benzene vapour to be above the upper concentration limit of the tube at <60 ppm.

Tank 6CP was washed with cold water during that same time frame when at 21:30 the hot water was switched to that tank for a further hour.

By 22:00 a blower had been fitted to tank 3CS tank cleaning hatch and the vapour lines were connected in parallel to the PSV and the 4" flex hose lashed to the PSV header, both discharging vapour ~4m above the deck, and tank venting began.

EPA did not stay on the vessel until the completion of the tank venting operation, which was to have been completed by 3 am on 25 April 2003 given that no further delays were encountered in the paraffin washing operation. By this stage of the operations we had gained a sufficient understanding of the tank cleaning methodology and its impacts upon the Melbourne airshed.

4. Conclusions

The inspection showed that EPA had to wait just over 6 months for a ship to visit the outer anchorage for the purpose of cleaning a tank which had been in Benzene service. This fact clearly illustrates how rarely tank cleaning operations involving class 3 indicators are conducted at the outer anchorage. Most ships sail out of the bay and conduct the tank cleaning operation at sea under the control of the Marpol Convention.

The crew of the ship appeared to be acutely aware of the results of conducting environmentally sensitive operations within the confined and populated area of the mouth of the Yarra / Maribyrnong Rivers, and the organisation appears to have changed to recognise the results of the Aquamarine prosecution.

The vapour emissions associated with tank venting operations by definition occur at the end of the tank cleaning procedure hence ensuring that these emissions will only occur at the outer anchorage.

The outer anchorage is at best 13 km and at worst 3.3 km from land. Hence the atmospheric emissions that occur anywhere within that area this area can be considered to have a negligible effect on the nearest sensitive use.

The requirement for vessel entry when ship presents to receive a chemical parcel at Maribyrnong Number 1 ensures that the tanks vapour space is free of volatile hydrocarbons at the conclusion of the tank cleaning operations.