

“AN INVENTORY OF ENVIRONMENTAL MANAGEMENT SYSTEMS AND PRACTICES AT VISAKHAPATNAM PORT TRUST (VPT).

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ABSTRACT

The Visakhapatnam Harbour is really one of the wonders of the nature, and the existence of this natural harbour has transformed the sleepy fisherman village in to one of the fastest growing industrial cities of the world. The volumes of cargo transacted by the Visakhapatnam Port Trust and the dense and diversified industrial activity in and around, have resulted in severe dust pollution problems to the growing city. The increased concentrations of the dust coupled with the increased incidence of respiratory problems in the city and the pressure from the public, NGOs and the media, the VPT has modernized its environmental management systems on priority basis. This paper reports these environmental management systems adopted by the VPT with a special emphasis on the *mechanical Dust Suppression System* used to control dust pollution from the open stacks of the VPT.

INTRODUCTION

Major ports are often associated with high urbanization and thus it is essential that environmental protection need to be a priority area for the management of the ports. Most ports throughout the world, including India, practice different types of Environmental Management Systems (EMS) to minimize the pollution load generated out of cargo transactions. The Port Hedland at Nelson Point (Western Australia) (Web ref. 1) currently ship more than 62 million tons of iron ore a year. The semi-arid environment and the proximity of port facilities to the town, dust has been a significant environmental issue for Port Hedland. Dust management for the port facilities has focused on stockpiles, material handling, traffic and open areas.

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Port Trust (VPT) has modernized its environmental management systems on priority basis (Sivaramakrishna, 2004). This paper reports these environmental management systems adopted by the VPT with a special emphasis on the *mechanical Dust Suppression System* used to control dust pollution from the open stacks of the VPT.

METHODS

The Environmental Management Systems adopted by the VPT for controlling particulate matter at different facilities, were first reviewed from the VPT documents. The information related to the functioning of the systems was documented through personal observations at various facilities, and the observed information was compared with the information collected from the secondary sources.

For EMS, secondary sources included (a) records of the VPT related to operation of the Environmental Management Systems; (b) designs and descriptions of the systems from the reports or specifications as reported by the manufacturers or suppliers; (c) other miscellaneous reports or studies on the environmental management of the VPT.

Information on the dust generating cargo (DGC) handled during the study period was compiled from the daily records of the *Berthing Programme* charts and also from the VPT records of the stockpile yards. The dust generating cargo was further classified into three categories based on their quantum and handling systems: **Coal based**; **Iron ore**; and **others**.

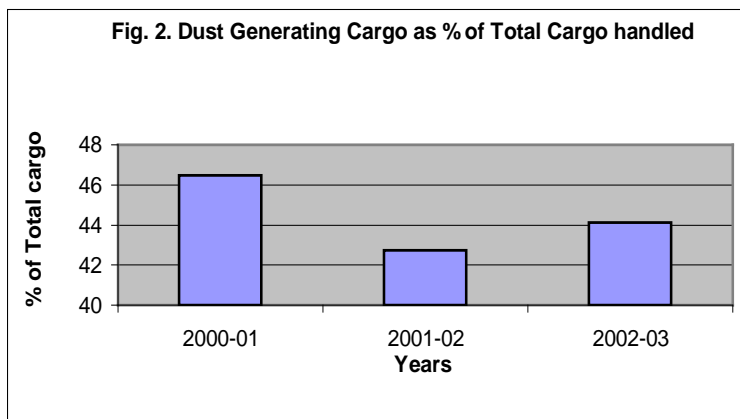
RESULTS AND DISCUSSION

The Visakhapatnam Port is a major port on the East Coast of India and is involved in handling both Exports and Imports. The Visakhapatnam Port, started its operations with a modest turn over of 0.3 million tons in 1933, and steadily increased its cargo traffic both in terms of quantity as well as number of items transacted and occupied the top slot among the major ports of India. A majority of the cargo transactions at VPT account for dust generation. For the purpose of the present study, to reduce complexity and for the sake of convenience, the Dust Generating Cargo was classified based on some common property along with the types of systems adopted for handling. The DGC was classified into three categories as

- **Coal based**
- **Iron ores** and
- **Others.**

ANNUAL QUANTITIES HANDLED:

The data relating to total traffic at VPT show that the dust generating cargo (DGC) handled during the years 2000-01, 2001-02 & 2002-03 was 14.8 MT, 14.9 MT and 15.7 MT respectively (Fig.1).



The three years average for the DGC handled was 1.26 Mt/month. The DGC has accounted for 46.48% of the total Cargo handled during 2000-01; while during

2001-02 and 2002-03 it was 42.72% and 44.13%, respectively. The DGC handled during 2001-02 has increased by 1.38 lakh ton over that of 2000-01. Similarly about 7.91 lakh tons of DGC has increased during 2002-03. A greater part of the increase was contributed by the Coal-based DGC.

SOURCES OF DUST GENERATION :

VPT handles enormous quantities of dusty cargo and hazardous wastes and this cargo is mostly stacked in huge quantities in open storage yards. These piled cargos are easily wind blown and hence contribute to dust pollution. The off loading operations at different berths also generate dust in sufficient quantities. In the vicinity of the VPT, large warehouses are situated which, resort to open storage of dusty cargo with no environmental safeguards. The by-products and waste products of the materials utilized by several industries adjacent to VPT and the heavy truck transport, all conveyor transfers, loading and discharge points of all bins or hoppers also generate huge volumes of dust. Dust is also generated from dried dumps and dredged materials.

Equipments used to handle DGC include Loading spouts, Trimmers, Conveyor belts, Ship discharge grabs, Continuous unloaders and Pneumatic unloaders. The following are considered as important factors that favours dust pollution while using these equipments:

- Large drop heights, splash of entrained air.
- Throwing bulk material through air.
- Wind erosion, spillage carry - back; transfer points.
- Grab impact, spillage from overfilling, leakage from Jawseals, grab discharge, wind erosion, collapse of cliffs.
- Dust passing through dedusting plants.

- Holding clean up.

Similarly, important factors for the activities at the Dock side, vehicle loading and movement are

- Falling stream, wind erosion, spillage.
- Wind erosion, spillage and disturbance of deposits.

SITES OF DUST GENERATION:

Coal is stacked at the *General cargo berth* up to a height of about 4.5 m in available areas. There is no definite pattern of stacking and stacking is done haphazardly. The *West Quay Berths* mainly handles coal. The coal stockpiles adjacent to the berths cover an area of 1, 78,296 m² and have a storage capacity of 2, 56,736 tons of coal. Coal is stacked up to a height of about 4.5 m in available areas. As in the case of *GCB* there is no definite pattern of stacking, which is done haphazardly. At present Coal is stacked in some places of the *North / South of S4 Conveyor*. Although present stacking is not much, coal is proposed to be stacked up to a height of about 4.5 m in available areas.

The transactions related to coal at the *GCB, WQB* and *North / South of S4 Conveyor* are the potential sources of dust generation. Besides, the handling of Mineral ores and others at all the operational berths, and other stacking areas are the potential sources of dust generation. In addition to the cargo transactions, the transport system in vogue for transporting various cargoes is contributing considerable dust.

SYSTEMS ADOPTED FOR DUST SUPPRESSION:

Dust suppression is achieved through the adoption of various systems and practices depending on the type of cargo.

Iron Ore:

Stockpiles receive the Iron ore coming from the wagons through receiving conveyors. The ore is stacked in three stockpiles viz. east, middle and west. The ore is transported from the ore-handling complex to the ship through an overhead conveyor system. The chances of dust generation during the handling of ore are being controlled / mitigated as follows:

- Installation of dust sucking units like bag filters (1092 nos) and blowers at nine aspiration points of ore handling complex and transfer points.
- Arrangement of water sprinklers at all the three tippers namely east, west and third tippers at OHC to cater to the needs of sprinkling of water through a system of G.I. pipeline through nozzles.
- Transportation of Iron ore through soundproof overhead closed conveyor system to eliminate dust emission and Noise pollution.
- Use of Bucket Wheel Reclaimers at ore handling.

Coal:

Coal is being handled at two places one is at General Cargo Berth and other at west quay berth. The following mitigation measures are being implemented during handling.

- Since drop height determines the dust emission, the drop height for the ship's hatches from the loader is maintained at a minimum by a suitably designed closed hood.
- Sprinkling of water to a tune of minimum twenty-eight tanker loads of water at W.O.B and TNEB areas & thirty-four tanker loads of water at general cargo berths to combat dust pollution.
- Covering of trucks with tarpaulins during transportation and regulation of speed of vehicles and deployment of leak proof trucks.

Sulphur and Rock Phosphate:

- Use of silos and a closed raise conveyor system for handling fertilizer.
- Deployment of trucks in good condition and leak proof bodies to avoid spillage.
- Covering open heaps with large plastic covers.
- Wetting of cargo

Alumina:

- Installation of a closed conveyor system to eliminate dust emissions.

PROMOTING GREENERY:

- A thick green belt has the capacity to serve as an effective dust trap. During the years 1998-1999, 1999-2000 and 2000-2001 VPT has planted, 23000, 75,000 and 1,00,000 plants respectively near the stacked areas to take care of the dust problem generated through cargo transactions.
- At GCB, a green belt has been developed along the entire boundary on the northwestern side and truck mounted sprinklers are being used to spray water on the stockpiles and

roads. This spraying has reduced the dust nuisance to some extent but the results are not satisfactory.

- At WQB, a green belt has been developed along the entire boundary on the western side and truck mounted sprinklers are being used to spray water on the stockpiles and roads. This spraying has reduced the dust nuisance to some extent but the results are not satisfactory.
- At N/S S4, sprinkling is being done by truck-mounted sprinklers on the road along S4 conveyor to reduce transport related dust emissions.

MECHANICAL SYSTEM FOR DUST SUPPRESSION:

General description of the System:

The mechanical systems adopted by VPT for dust suppression were designed and installed by M/s **Meccon & Co., India**. In these mechanical systems, water is sprayed with the help of circular swiveling type sprinklers, which are mounted on vertical stand posts and are tapped from underground water headers. The stand-posts are 1.8 m above the ground for sprinklers located inside the stockpiles, the stand-posts can rise up to a height of 5 m to avoid submergence by the stacked material. The flow of water through the sprinklers is controlled manually with the help of globe valves. Gate valves and Spring-loaded Pressure Relief Valves are provided at pump outlets.

The sprinklers are bunched in groups of 4 to 9 from a common header, and all the groups are arranged as rows in the area and are planned in such a way that all areas of the stockpile and the peripheral roads around the stockpile are covered for dust suppression.

Each group of sprinklers is operated by a butterfly valve, conveniently located at easily accessible points. The spacing and

location of sprinklers were arranged considering a throw of 40m by each sprinkler.

Each area is provided with RCC tanks and individual pumps are provided for supplying water to the sprinklers. Dry running protection of pumps is also provided. The pumps shall be operated from the respective pump houses and operation of pumps and valves is manual.

The operator will first ensure filling of the individual dust suppression tank and he will check that the butterfly valves of all sprinkler groups are closed. He will then start the dust suppression pumps and then open the butterfly valve for the first group of sprinklers. After ensuring sprinkling for the pre-determined duration as mentioned above, he will close the valve and start the second group of sprinklers and so on till one cycle is completed.

The number of cycles to be operated in one shift shall be judged at site based on prevailing weather conditions and fugitive dust generation. The operation frequency is decided based on the extent of wetting after one cycle.

The operator may decide to slightly increase or decrease the sprinkling duration by judging the extent of wetting and after one cycle is completed, he will move to the next area and so on till all areas are covered. The operator will decide the time of start of the second cycle by judging the extent of wetting and the fugitive dust generation. Active areas of the stockpile will require more sprinkling than the inactive areas and the operator will decide this at site.

Water supply systems:

The service water for the mechanical dust suppression system is being collected from treated water pond having minimum storage capacity of 105 m³. Three horizontal centrifugal pumps (2W + 1S), each having a capacity of 200 m³/hr and head 120 mWC are envisaged for pumping the service water to different dust suppression tanks located at various places. These three pumps are located in the main pump house adjacent to the treated water pond.

The treated water is collected into the pond by gravity and pumped through an underground pipe of DN 300. DN 300 carry the water underground along the pipe laid for carrying water to the dust suppression tank of the west quay berth. Near the conveyor gallery S4, a tapping of DN 250 is provided for the proposed dust suppression system of ore handling complex and will run along the S4 gallery up to the existing wagon tippler.

The main header of DN 300 is taken above the conveyor gallery S4 at suitable location along the column of the conveyor gallery and thereafter, the pipe runs through the gallery. The main header of DN 300 will be laid all along the conveyor gallery S4 up to Junction House H9. Tapping has been provided from this header for different dust suppression systems. The sub branch headers are laid underground after taking it down from the conveyor gallery. This branch header is reduced to DN 200 after Junction House H8 and until Junction House H9 the header size continues the same.

Dust suppression tanks for east yard dumps and for open area at general cargo berth Junction are laid underground from Junction Houses H8 and H9, respectively.

Since a separate water supply system to the tank is already provided at west quay berth for dust suppression by VPT the water

supply to the dust suppression system of west quay has not been considered in the present system. However, except for service water

system all other systems like dust suppression including electricians has been considered for west quay berth area.

Although the pumping system is a manual one, in case water requirement reduces drastically due to non-operation of some of the dust suppression systems, pressure relief valve will operate and the excess water will go to the sump. This will protect the pump running against shut off head. Dry running protection for the pump is also provided. Mechanical type water flow meter is provided at main outlet line to monitor the water consumption.

While laying underground pipelines, all precautions like necessary wrapping and coating of the pipeline with 4mm thick tape as per AWWA 203 were followed. At rail track crossing, pipelines were laid inside RCC pipes of class NP-3 as per IS : 458 : 1988.

Dust suppression system at GCB :

A total of 34 sprinklers are installed in this area. Eleven groups of sprinklers with a maximum of 5 sprinklers per each group work at a time. Each group of sprinklers shall be operated for 8 minutes and the cycle time for all the eight groups to operate once will be 88 minutes.

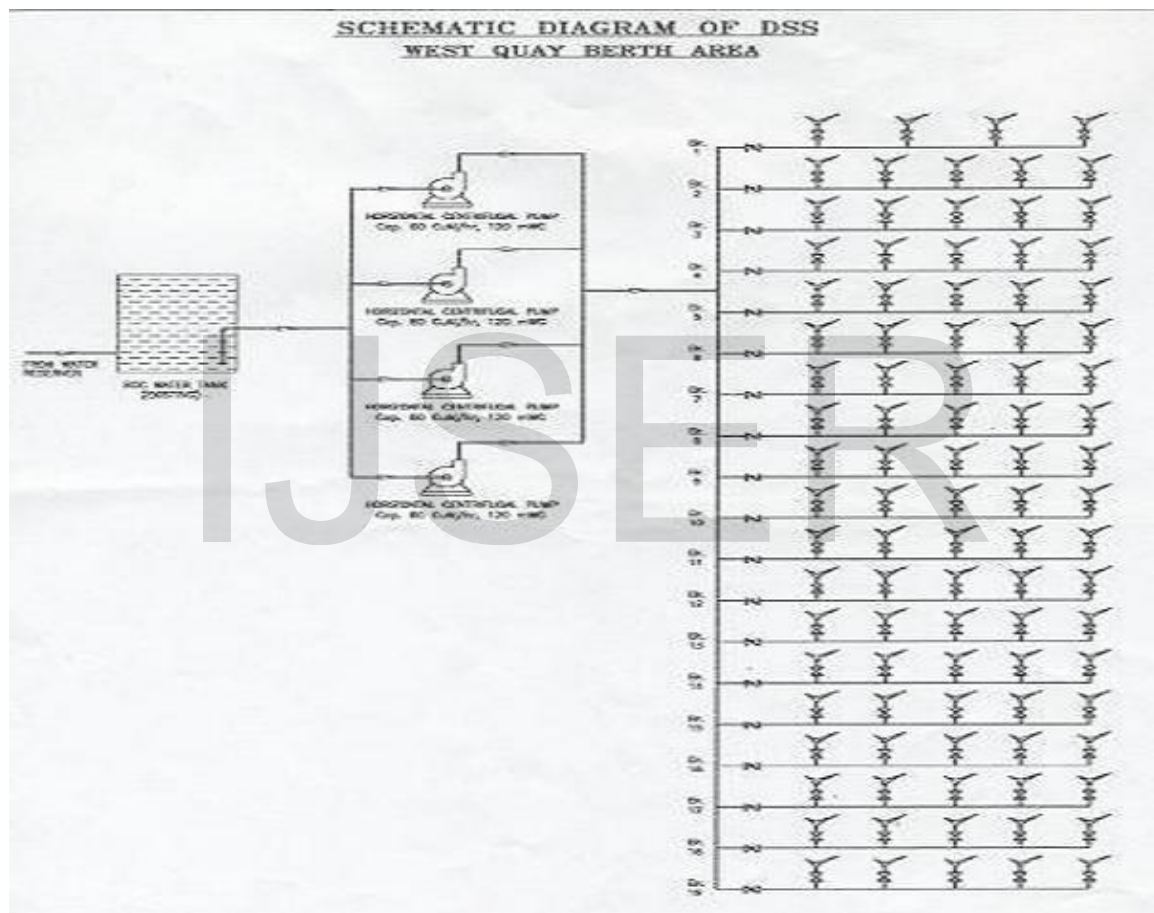
Dust suppression system at WQB:

A total of 94 sprinklers are installed in this area. Nineteen groups of sprinklers with a maximum of 5 sprinklers per each group work at a time (Fig. 2). Each group of sprinklers shall be operated for 7 minutes and the cycle time for all the nineteen groups to operate once will be 163 minutes.

Dust suppression system at N/S of S4:

A total of 44 sprinklers are installed in this area. Eleven groups of sprinklers with a maximum of 4 sprinklers per each group work at a time. Each group of sprinklers shall be operated for 12 minutes and the cycle time for all the eleven groups to operate once will be 132 minutes.

Figure 2. Schematic Diagram of Dust Suppression System at West Quay Berth of VPT.



World wide, several ports which handled dust generating cargo had to adopt particulate matter pollution control and during the past decade most ports have initiated Environmental management Systems, especially to control the dust pollution.

The mitigation measures adopted by the Southern Waterfront Port Tenants (Web ref. 2) include the following:

- Installation of truck wheel-washing systems at plant;
- Installation of Best Available Control Technologies (BACT) such as overhead sprays on construction material piles and unpaved roadways to maintain moisture content that prevent particles from becoming airborne.
- Limit the production of concrete or asphalt material produced to levels that do not result in truck travel volumes or operational emissions that exceed the levels analyzed in the Southern Waterfront SEIR.
- Conduct ongoing street sweeping operations.
- Requirements for good faith efforts for tenants to engage in operational practices like measures to reduce diesel emissions. The Port offers economic incentive to realize this objective by contributing towards the cost differential of alternative or low-emission fuels, or vehicles and/or engine technologies.
- Several of the Port's tenants, use a low emission diesel fuel such as Lubrizol, while others have upgraded their trucks to newer, lower-emission models.

The Dust Management Performance Improvement Programme (Dust MPIP) of The Port Hedland at Nelson Point, Western Australia, (Web ref. 1) include installing low-frequency microwave moisture analyzers, installing bulk ore conditioning sprays, and continuing previous management programs including belt washing stations. Ore moisture conditioning has been significant in mitigating dust emissions and has also reduced the need for water reticulation during product handling and stockpiling.

In order to control the dust generation from various activities, the VPT has initiated mitigation measures, as described earlier, most of which are comparable to several other ports in India and else

where. Sprinkling or spraying of water over the DGC while stacking or before transport are the most widely adopted practices throughout the world. However, different ports employ different techniques, like manually, using mobile trucks or employing power operated mechanical sprinklers etc. depending on the quantities handled every year.

Mohan Rao (2005) has studied and reported the efficacy of the mechanical dust suppression system adopted by the VPT using the data on ambient air monitoring supported by biomonitoring techniques. The study compared the monthly values of the SPM (Suspended Particulate Matter) and RSPM (Respirable Suspended Particulate Matter) of the periods 18 months before and after (June 2002) the establishment of the new system and concluded that the mechanical dust suppression system adopted by the VPT since June 2002 has resulted in reducing the incidence of the Peak levels of the SPM and RSPM very significantly.

REFERENCES

Mohan Rao, P.V.J. (2005) Efficiency Appraisal of Environmental Management Systems related to Control of Particulate Matter of Visakhapatnam Port trust (VPT). **Ph.D. Thesis**, Andhra University, Visakhapatnam, India.

Sivaramakrishna.P.,(2004),Studies on Environmental Management Practices at Visakhapatnam Port Trust, **M.Sc., Dissertation**, Andhra University, Visakhapatnam, India.

Web References:

1. www.deh.gov.au/settlements/industry/minerals/booklets/dust/case1.html - 37k.
2. www.sfport.com/site/uploadedfiles/sfport/Dust%20Summary%20Report.pdf

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