CHAPTER 6

SUMMARY

This short-term study (one semester duration) focussed on a dust-emitting paint manufacturing plant and dealt with the following matters:

1. Paint dust from the solvent-based and the water-based paint manufacturing processes were collected separately from each of the two dust-collection equipment of the pulse-air- jet type of bag filter installed at the plant.

2. The particle size and particle size distribution of each dust type were determined by the use of COULTER LS 230 Particle Size Analyzer. It was found that the volume weighted mean particle diameter of the solvent-based paint dust and the water-based paint dust is 0.941±0.016 μm and 8.185±0.201μm respectively. The solvent-based paint dust is significantly finer than the water-based paint dust by nine times. Within this size range, the particles can be deposited in the lungs as far as the bronchioles.

3. In order to improve the present dust emission management, it may be desirable to consider an installation of an electrostatic precipitator (ESP's) downstream of the bag filter to scrub the finer dust of the solvent-based paint manufacturing factory. This measure would enhance the compliance of regulatory requirements, the Environmental

Quality (Clean Air) Regulations,1978. However, the budgetary constraints need also to be considered .

4. Particle size measurement is of paramount importance in dust pollution studies because it determines the choice of appropriate dust-collection equipment for the particle in question and also determines the potential inhalation deposition of the particles in the lungs which may give rise to serious health concerns.

5. Elemental composition and their concentrations in dust samples were analysed . A total of 8 elements were detected and they were arsenic, cadmium, chromium, cobalt, copper, nickel, lead and zinc. Four heavy metal elements were selected for detailed study on the basis of excessive concentrations and their environmental health hazards to the workers due to their potential toxicity. These four elements were arsenic, copper, lead and zinc.

6. The concentrations of these elements were determined by the method of inductively coupled plasma-atomic emission spectrometry (ICP-AES) which is capable of simultaneous multi-elemental analysis. The capability and usefulness of this technique is well documented in the literatures and is critically reviewed with respect to paint dust characterization and pollution studies.

7. The finer solvent-based paint dust is found to contain a much higher concentrations of these elements than the coarser water-based paint dust, indicating the possibly greater

toxicity nature of the solvent-based paint dust as compared to the water-based paint dust. Although inconclusive, this has an implication on the size-related absorption capacity of particle. Lead and zinc are the predominant elements in the solvent-based paint dust whilst zinc is the predominant element in the water-based paint dust.

8. In view of the potential toxicity of paint dust, the following recommendations were proposed with regard to the minimization, reduction and control of paint dust emission within the plant:

(a) Workers in the factory should be strictly compelled to wear masks. The masks must be able to trap fine particles in the air and must fit snugly when worn.

(b) The dust-collection equipment should be maintained regularly to check its efficiency. Any change in the production process which may affect the size of paint dust particles should be promptly communicated to the personnel in charge of the maintenance of the dust-collection equipment for appropriate actions to be taken swiftly.

(c) Paint dust should, wherever and whenever possible, be recycled and re-used rather than simply disposed off in a landfill.

(d) Water-soluble bags could be used to reduce pigment waste from bags and packages especially for the manufacture of water-based paint.

(e) Paste pigment which are wetted or mixed with resins may be used in place of dry powder pigments to avoid dust emission and dispersal.

(f) Barrels collecting paint dust from dust-collecting hopper should be monitored closely to ensure that barrels are replaced immediately when fully filled so as to avoid

any spillage on the floor as it takes only a slight draught to agitate and disperse the dust, thereby polluting the surrounding air.

(g) Separate baghouse may be installed for each of the production steps (pre-mixing, dispersion, transfer and mixing) so that the collected pigment dust or resin dust may be recycled and re-used.