DUST....our enemy

- a document upon the current perception in the Indian Industry and the way forward

Programme Structure of Seminar on Dust Control by F. Harley and The Raring Corporation, USA (Technical Collaborator for ADS™ Dry Fog type Dust Suppression Systems on 10th February 2016

Welcome address	Namit Shah
Our journey in Dust Suppression	S. K. Mitra
Physics of Fog	David Raring
Demo clip and installation video	S. K. Mitra
How to size a fog system	David Raring & S. Maiti
Essential System Specifications	David Raring & S. K. Mitra
Environmental Regulations and Laws	Nirav Shah
How to measure efficiency of a system	Nirav Shah & S. Maiti
Closing address	Namit Shah

PREFACE

Namit Shah, MD

Thank you for attending our company seminar on February 10, 2016 on the subject of Dry Fog Dust Suppression Systems.

Over the years our company has continuously engaged with both consultants and customers through technical seminars that we have had along with our overseas collaborators, M/s. The Raring Corporation, USA.

The thrust of our most recent interaction has been a bit different from the past. We have concentrated on areas that have been hitherto not addressed but have felt it necessary to bring into sharp focus the following :

a. Sizing of a Dry Fog Dust Suppression System based on spread of sonic nozzles which has a correlation with an estimation of dust at each application point. Factors that influence the sizing were also highlighted with a mathematical model based on U.S. EPA 42 and CEMA Standards.

b. Guidelines for specifying Fog Dust Control Systems with highlighting of critical aspects that need to be definitely specified, to ensure no dilution of system or technology.

c. A part of this also covers the appropriate way to measure the efficiency of a Fog Dust Control System and suggest that it is necessary to look at system efficiency in a new light.

d. Prevailing environmental rules and regulations that exist from the National Ambient Air Quality Standard (NAAQS), Ministry of Environment & Forest (MoEF) as well as The Factories Act. This sheds light on what are the prevailing specified limits for particulate dust matter, particularly respirable dust and how some of the rules (Factories Act) are being applied in an incorrect context when it comes to performance guarantee expectation from a Fog Dust Control System.

To ensure that much of the material which was discussed is usable for your future work in this area, we have put together a CD (enclosed at the end of this document) on the above areas in complete details, excepting the Fugitive Dust Calculator (possibly the first in the industry) which shall be made available to you by a software shortly.

In addition to the above and based upon our interactions at the seminar we provide as enclosed recommendations from the day's programme in the form of a document titled '***Broad Guidelines to Building and Operating a Clean & Hygienic CHP / MHP***'.

This document is prepared on the basic premise that a material handling plant is as dusty or clean on the part of Consultants, Material Handling OEM's and Plant Owners as it is designed to be or how it is maintained coupled with the intention to remove misplaced expectations that Dust Control Systems alone are sufficient to take care of the plant dust pollution woes and deliver the norms.

We recommend that this document be inserted in the Technical Specifications for Bulk Material Handling Plants to ensure a level playing field to all companies in the BMHP business as a starting point towards building clean plants. We would welcome improvement upon this document and for it to be shared, but eventually all of it must find it's way in the Technical Specifications prepared by the Consultants or any Plant Owner preparing it's own specifications. This will require a collective effort starting at least from this seminar.

We hope that the information shared would have helped to shape a new direction while designing Bulk Material Handling Plants and in evaluating and specifying a Fog Dust Suppression System, respectively, in the upcoming projects.

Thanking you,

Namit Shah
Managing Director

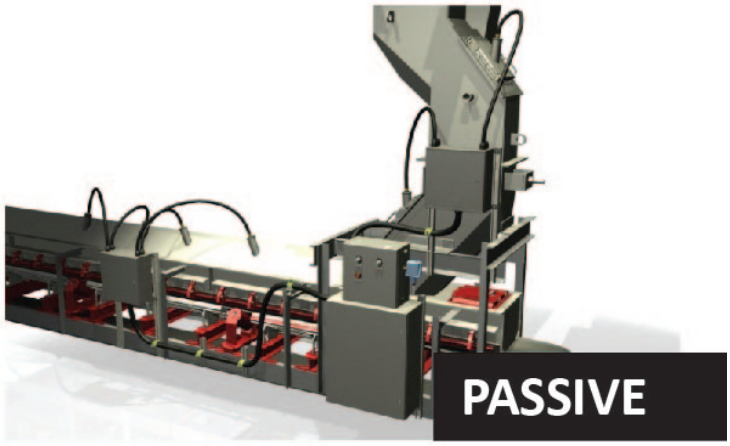
CC : M/s MECON Ltd.
M/s M. N. Dastur & Co.
M/s Development Consulting Engineers
M/s Tata Consulting Engineers
M/s Larsen & Toubro Ltd.
M/s McNally Bharat Engineering Ltd.
M/s ThyssenKrupp India
M/s SANDVIK
M/s TRF
M/s MACMET

Respect DUST CONTROL for the **LOVE** of our **FUTURE**

Session Summary
- Key Recommendations & Take-Aways

 # 1 Passive & Active Dust Control

PASSIVE + ACTIVE = EFFICIENT : The ADS™ "Dry Fog" system is a combination of Passive and Active technologies. The containment we specify or supply is, by itself, a passive dust control system. Considering engineered flow chutes, large settling volume, and stilling baffles, this passive system can be as much as 90 or 95% efficient dust control leaving only the very fine fraction of the dust for the active system to address



 # 2 The Fog Application Principles

Provide Containment

The most important feature of a dry fog system is the way that it contains the fog and dust to create a controlled micro-environment. A dry fog system is an in situ fine particulate scrubber.

Create and Project Fog

Fog is a dense cloud of 0-30 micron water droplets. There must be enough fog to scrub the dust (scrubbing ratio) and the spray must have adequate kinetic energy to penetrate the air flow. This is achieved in the dry fog based system through the air driven acoustic oscillatory nozzles, which is the heart of the dry fog system.

Retention Time

It takes time for the fog and dust to agglomerate. There must be enough volume within the containment to provide the necessary time for the point-specific application.

Collection Surface

Providing collection surface and turbulence within the containment reduces the retention time required.

3 System Design Basis

This is done by estimating the PM10 dust emission at each application point through the use of USEPA AP 42 Uncontrolled Emission Factors Guidelines. To arrive at this estimate, the following key inputs are required to be either known or carefully presumed as they have a co-relation with dust generation :

- Height of Fall
- Induced air flow through a Transfer Point
- Average Lump Size
- Free Moisture in materials
- Engineered Enclosures

Each of the above have a massive impact on the dust generation as was shown through the mathematical model.

The estimated PM10 dust emission has to be countered with moisture in the form of fog and the moisture addition needs to follow a scrubbing ratio of 8-10 times the estimated PM10 dust emission.

The release of moisture (read fog) into the enclosure is to be translated to a distribution of fogging nozzles at the discharge and receipt points following the recommended spread of nozzles along with the enclosure width, to ensure agglomeration of dust with the fog.

4 Essential System Specifications (Dry Fog)

To avoid any of the necessary ingredients being missed out in specifying a Dry Fog based Dust Suppression System for effective dust control, common salient points related to basic arrangements for it's functioning in the form of containment for passive dust control, necessary hardware in the form of nozzles, understanding upon the other sources of dust generation which impacts the overall appreciation of the dust control system in place and specific scope defining of a dust control system.

5 Misplaced Expectations from a Dust Control System owing to incomplete understanding of the Environmental Laws & Regulations

Due to incorrect understanding of the norms / statutes, the Technical Specifications have been so long framed in a manner by various agencies involved, which has led the Indian Industry to think that a Dust Control System alone is enough for compliance of the CPCB / MoEF set norms and the Factories Act norms, respectively. All of it resulting in unrealistic performance expectations from Dust Control Systems, while the onus for compliance lies with the Plant Owner through building and operating bulk material plants applying the best engineering practices and by continuous improvement and maintenance of all the control measures in place, of which one of them is a Dust Control System. This makes it all the more necessary to approach framing of Technical Specifications in a more involved manner, ensuring that the Plant Owner does not face issues at a later date.

6 Performance Efficiency of Dry Fog System

The Dry Fog System which acts specifically upon the dust generated at the applications points, primarily needs to be evaluated with a 'system on' and 'system off' performance efficiency check through high volume sampling, considering that all other sources of dust generation are well under control.

In view of the misunderstanding of the norms, emissions control on dust concentration basis in the work zone must be discussed and arrived on a mutually agreed basis.

Considering the Performance Efficiency method which may also be mutually agreed upon depending on factors viz. TPH and dust properties.

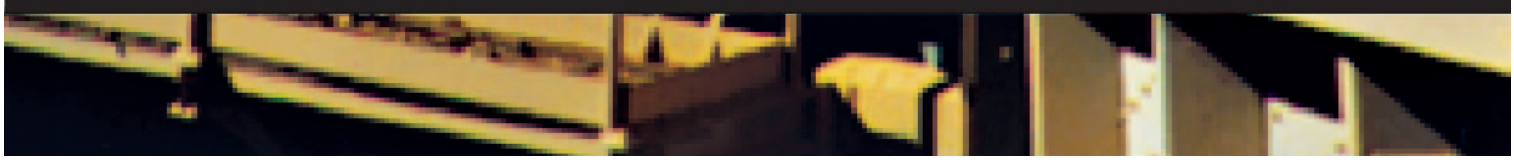
Also, combination of both Performance Efficiency or Work Zone Dust Concentration Levels may even be considered on 'whichever is higher basis' on a mutually agreed basis. While the Performance Efficiency Test may be done based on Total Suspended Particulate (TSP), the Work Zone Dust Concentration Levels would be for dust in the PM10 range.

Primary Challenges in tackling *Dust Control*

- Overall, Air Pollution not taken seriously
- More attention towards Green House Gases (GHG's) & Stack Emissions
- Least attention towards improvement in Work Area Hygiene at the ground level
- Low priority to Particulate Matter (PM)- an Air Pollutant most visible , causing maximum nuisance affecting the ambient air quality, which is ignored and taken for granted
- Incomplete understanding of the emission and personal exposure level norms, and application of the same as laid out in Technical Specifications, resulting in misplaced expectations that Dust Control Systems alone shall take care of all dust nuisance problems and deliver the norms too.
- Dust nuisance and it's control is mostly not conceived and not considered as a priority , or as an integral part of operating the Plant
- Prevalence of low awareness levels in appreciating that multiple control measures need to be in place to achieve the norms through implementation of good engineering and management practices

The '4DS' Approach – understanding ALL Dust Sources

- Statistically, Dust Control Systems takes care of only 25% of the problem
- Balance 75% Dust Sources lie within the plant design and daily practices



Understanding the '4DS' Approach

#1A

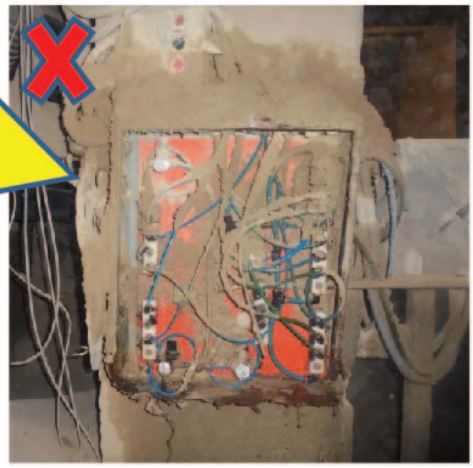
Dust Control Systems either ineffective or poorly maintained – Dust Suppression Systems

The effectiveness of a Dust Control System is only known through it's use and a commitment to maintain it, operate it and report any such issues faced. But, quite often the facts of it's effectiveness is hidden by poor maintenance of the Dust Control Systems . Here are a few examples ;

Nozzles choked with material, not cleaned (as circled)

Spray Panel almost buried !

Fogging Panel for generating Fog to control dust nuisance fully clogged with material and with no panel door.



No respect for **Dust Control Systems** !

Understanding the '4DS' Approach

#1B

Dust Control Systems either ineffective or poorly maintained – Dust Extraction Systems

The effectiveness of a Dust Control System is only known through it's use and a commitment to maintain it, operate it and report any such issues faced. But, quite often the facts of it's effectiveness is hidden by poor maintenance of the Dust Control Systems . Here are a few examples ;

No respect for **Dust Control Systems** !

Understanding the '4DS' Approach

#2

Technological and / or inherent inadequacies in the BMHPs resulting in dust leakage / puffing i.e.

Incomplete technological equipment / accessories and / or inherent design inadequacies resulting in ineffective containment causing consistent dust leakage / puffing and consistent increase in dust concentration. To be addressed with the proposed incorporations ;

- Ensure **optimum height of fall** based on material dustiness properties to avoid impact and uncontrollable dust nuisance at receipt point
- Universal pad for **impact absorption** at Receipt Point
- **Adequate skirt length and height** to contain the dust for belt conveyor applications
- Well thought out and adequate **self containment arrangements for applications other than belt conveyors**
- **Proper ventilation in the building / house**, otherwise affecting adequate number of air changes and to avoid build up of dust concentration therein.
- Effect of cross wind blowing through the building / house to be minimized through effective containment to avoid carrying dust to other areas causing increase in dust levels in the uncontaminated areas.

Excessive height of fall

Cross wind blowing through the building

Inadequate Skirt height

Understanding the '4DS' Approach

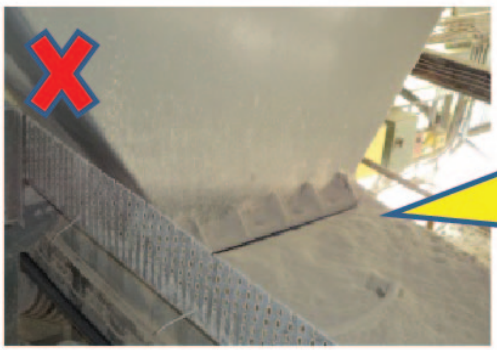
#3

Poor or inadequate maintenance of dust producing equipment, processes or area

- Leakage from skirt sealings & spillage due to improper belt alignment
- Leakage of dust due to holes or cracks in chutes
- Broken / missing inspection doors and clamps thereof resulting in openings for dust leakage.
- Identification of non moving idlers and it's removal and replacement of the same.
- Inspection and adjustment of all belt conveyor and their skirting rubber and dust seals
- Improper / incomplete boxing up of the equipment and accessories after any maintenance work.
- Grated flooring / holes in the flooring causing dust contamination, increase in dust levels in the lower floor level and dust accumulation etc.

Missing Inspection Door

Grated flooring causing pile up below



Opening / Crack in Chute

Discharge Hood not boxed back

Openings below the Screen

Understanding the '4DS' Approach

#4

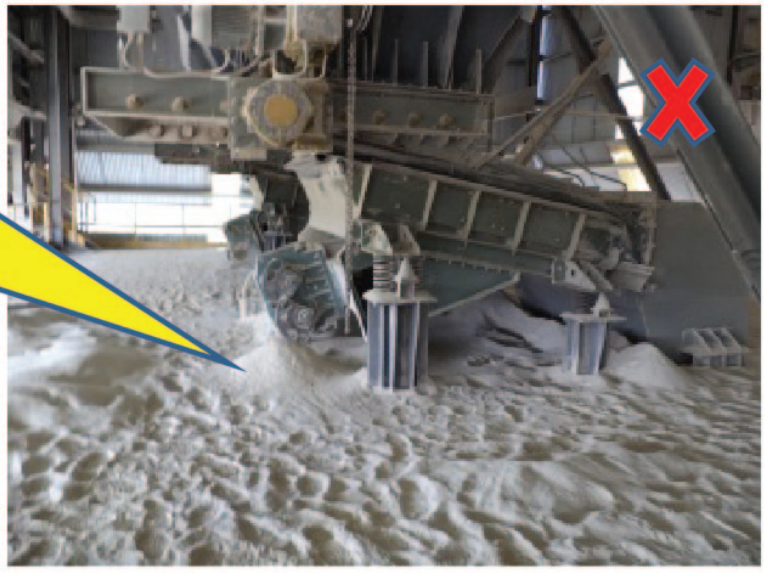
Improvement in housekeeping and maintenance practices

The Causes.....

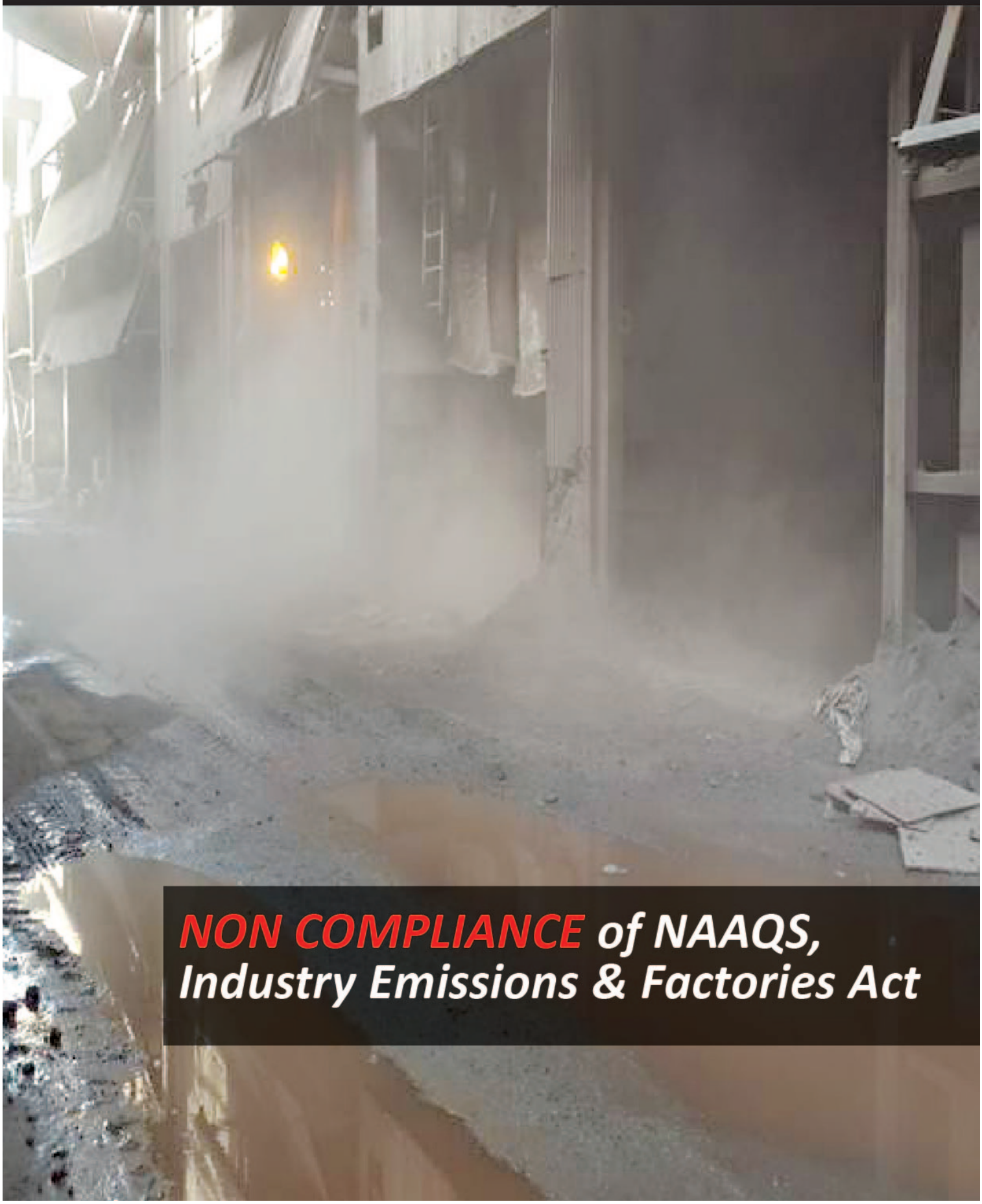
- Allowing dust accumulations and delay in clean up of the same
- Cleaning with brooms and shovels prompting subsequent dust generation in the building / house,
- Irregular cleaning and washing of the floors failing to keep it void of spilled over dust and it's build up over time etc.

Dust Accumulation caused in the **outside** area

Irregular cleaning of floors causing dust build up **inside** the building

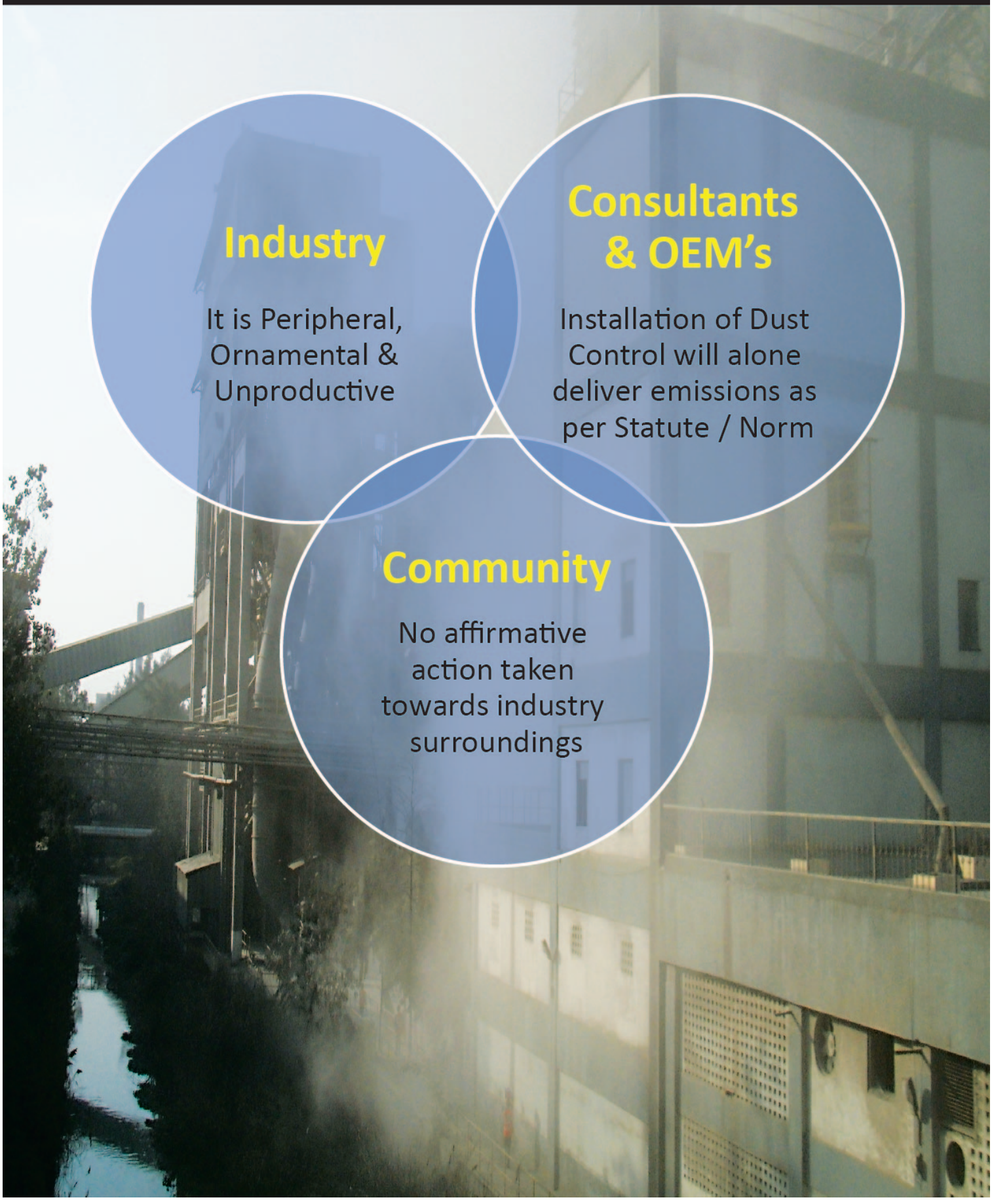


Result of not adopting the '4DS' Approach



***NON COMPLIANCE** of NAAQS, Industry Emissions & Factories Act*

The Perception towards Dust Control....



The 'THINKING' that should be towards Dust Control.....

Meeting the Statutes - a common responsibility

Correct understanding and implementation will reduce Dust Concentration Levels, thus reducing Worker's exposure levels to dusty environment with multiple control measures in place & not narrowly dependent on Dust Control System only

The Way Forward
- weaving the thinking into Technical Specifications !

As already covered in this document, the thinking towards Dust Control now requires a broad spectrum approach. Along with this document are some suggested guidelines, which may be inserted in Technical Specifications in the designing and construction of Bulk Material Handling Plants, as finally the Plant would be just as dusty or as clean as it is conceived and designed which would then be a liability for the Plant Owner. In fact, this is not any type of elevation of standards in designing Bulk Material Handling Plants, but only an alignment, an approach, an effort to comply with the statutes for a Cleaner India !

Therefore, it becomes all more necessary for implementation of *'good engineering and management practices'* as outlined in the guideline document titled *'Broad Guidelines to building and operating a Clean & Hygienic CHP / MHP' (available in the enclosed CD)*. This is meant to sensitize the Consultants, Bulk Material Handling Plant / Equipment Manufacturers and the Plant Owners upon the ingredients in achieving better Dust Control and compliance with the norms.

the first step to DUST control is - don't let it out !

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This compilation is based on the collective practical experience of the Company and it's Engineers, both from the past and present, having experienced challenges along the way

#1 DUST CONTROL SPECIALISTS

IMPROVING ENVIRONMENT