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FEATURES

- Global Coal Trades
- Coal Handling Technology
- The Netherlands
- Marine Paints & Coatings
- Conveyor Components
- Dust Control Systems

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F. Harley's customized dust control solution for track hopper at Paradip Port with ADS™ Dry Fog System

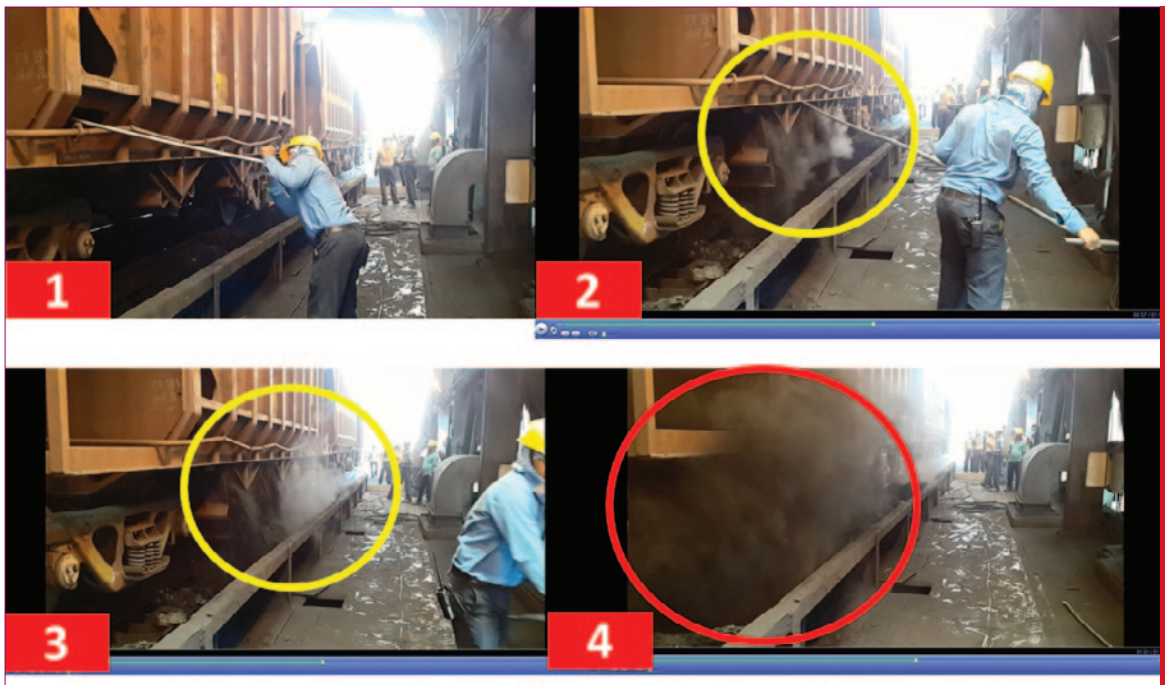
PPT scores India's first 'one-of-a-kind' victory over fugitive dust emissions at track hopper area — a major achievement in Occupational Health & Safety

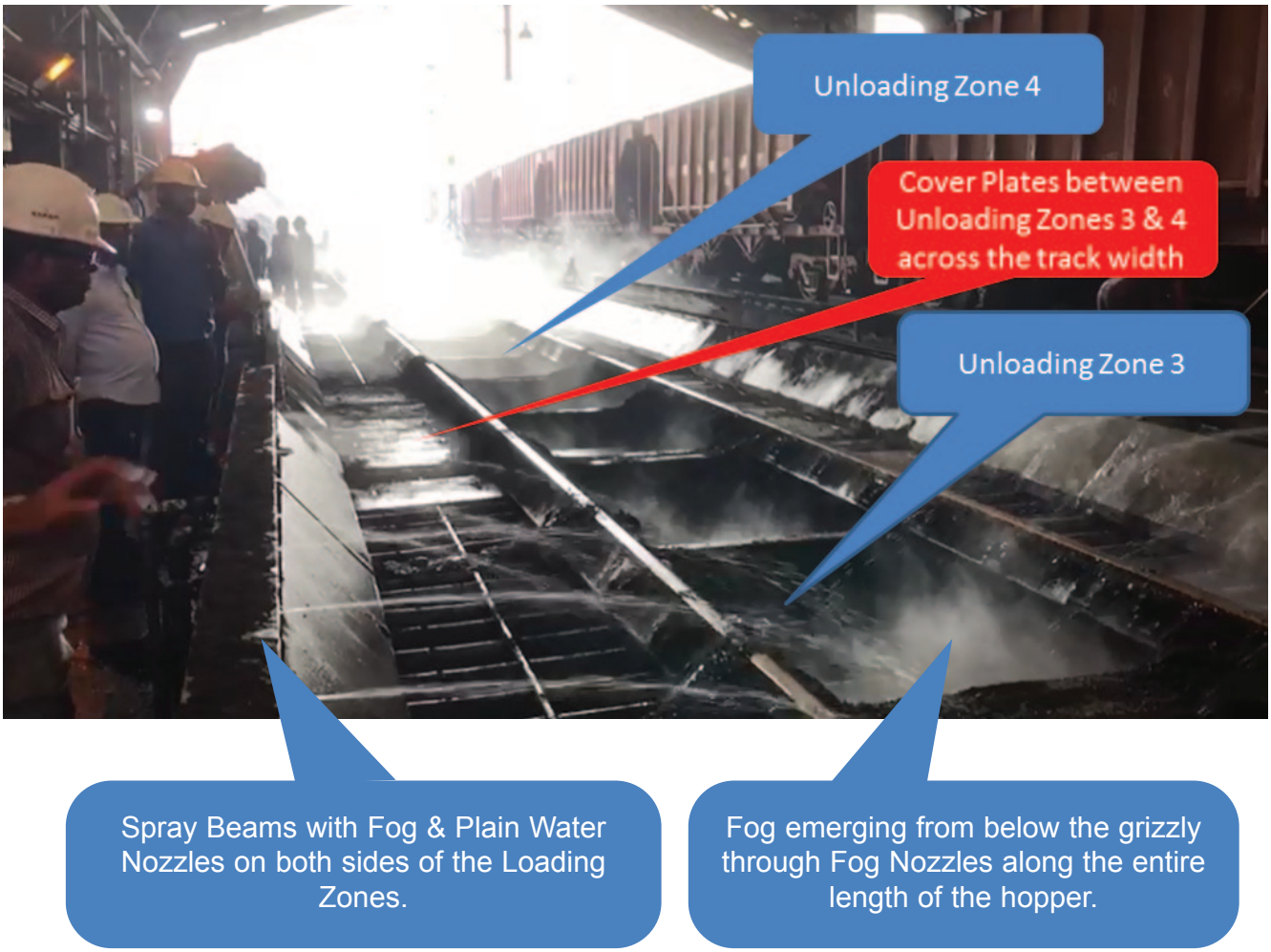
With Paradip Port Trust's annual coal cargo handling capacity of 29mt (million metric tonnes), the most challenging area bearing the brunt of fugitive dust emissions generated is the track hopper area, writes *Nirav Shah, Dy. Managing Director (F. Harley & Co. Pvt. Ltd)*.

F. Harley's DFDS System in full operation at the 29mtpa track hopper area since October 2018.

The original design has eight wagons unloading simultaneously, across two track hoppers with the unloading of four wagons each, in a relatively compact facility in just four minutes. In this scenario, the dust generated with only one wagon unloaded posed a severe daily health hazard for the personnel over the 18 years since the track hopper facility was set up. The objective therefore was to design a system which would actually allow 'eight wagons unloading simultaneously' for both track hoppers running parallel, as per the original thought and design — thereby facilitating a faster turnaround of wagons, and creating a safe working environment for all personnel, which was an objective over and above the pressure from the Orissa Pollution Control Board (OPCB).

The solution in place is one-a-kind for all of India. It controls the dust through highly customized containment and suppression techniques. More than this, it brings in a new work practice altogether which includes wagon positioning at designated positions along the track hopper for unloading. This is combined with timer-based fogging with sound alarm for deployment of manpower to open the bottom wagon gates, to ensure maximum advantage of the fog generation from the pre-filling to the post-filling stage to





eliminate visible emissions in the work area.

The arrangement is a joint effort of Indian, American and Chilean engineers, brought in through a technical collaboration with The Raring Corporation (USA) with its Indian Licensees F. Harley & Co. Pvt. Ltd., a major entity in the area of dust control for bulk material handling applications. In addition, the entire scheme has been vetted and approved by Paradip Port Trust's consultants, MECON Ltd., who had prepared the broad specifications for the project.

The dust suppression technique applied at the track hopper facility is commonly referred as the Dual Fluid Dust Suppression System or DFDS. This is improved further by The Raring Corporation and known as the ADS™ or Agglomerative Dust Suppression System which generates ultra fine water droplets in the form of dry fog which moistens and agglomerates like-sized dust particles in the form of dust plumes of even the respirable range (PM 10 — below 10µ) thus making it heavy and forcing it to fall back on to the parent material, and into the material flow.

On the whole, the solution provided is more than just fogging with the DFDS System, and shows the way forward for many track hopper facilities in the country.

Brief case history of the track hopper DFDS project

Prior to the installation of F. Harley's ADS™ Dry Fog Dust Suppression System at the track hopper was a high pressure system with no containment approach, but only generating mist (large water droplets) on an almost continuous basis, which practically had no impact upon the dust generated.

In effect, the quantum of uncontrolled dust generated during the unloading operation was monstrous in nature, which not only was an emission issue but a serious occupational hazard. This was indeed a huge challenge for F. Harley to take on. Nevertheless, it did so, slicing every aspect of the challenge and devising a control for the same.

ADS™ — the Dry Fog System by F. Harley at the track hopper

The dry fog dust suppression system, employs dual fluid sonic nozzles, generically known as air driven acoustic oscillator nozzles, which are the heart of the dry fog dust suppression system. These nozzles generate dense dry fog which is defined as 0–30µ droplets, similar to natural fog, which is created by atomizing water through injection of compressed air in a ratio at sonic velocity.

FP Series air-driven acoustic oscillator nozzle.

Integral to the ADS™ dust control strategy is the containment of the dust which is key to the success of any dust control method. As a first step, at the track hopper, containment was provided over the non-unloading zones (between the wagons) to stop the escape of high velocity dust-laden displaced air. By doing this, the nuisance control zones were minimized to the unloading points only, in place of the entire track on both sides.

Subsequent to the above was the application of fog along with plain water sprays (operated in a sequenced manner) at these defined unloading zones or nuisance zones (over the grizzly), but only around the period of the unloading operation. Along with the fog spray over the grizzly, fog was also introduced in the hopper across the entire length to humidify the dust-laden displaced air inside the hopper to enable agglomeration with fine water droplets with like-sized dust particles resulting in gain of mass and fall back into the material stream.

Between the fog and plain water, the purpose of the fog is to generate more fine-sized water droplets than like-sized dust particles generated in the handling process (to enable agglomeration), while the role of the plain water is to pre-wet the material at the time of fall to reduce the quantum of dust generated to the best possible extent.

While it is a combination system, the role of the fog is larger due to the sheer rate of generation of more fog than dust, and the kinetic force of the FP Series nozzles due to the compressed air which gives it the 'spine' to counter the displaced air velocity. This also assists in the interaction of fine water droplets with like-sized dust particles, resulting in more agglomeration.

The entire timing of the sprays coming on and off are controlled through a PLC, with a basic flexibility to change sequences, if required.

Mist (high-pressure system)

One wagon unloading at a time — and huge dust

Dense fog (ADS™ system)

Eight (4x2) wagons unloading at a time, and no visible dust

Conclusion

Dust control is all about observing the problem along with the operations and, if required, the operations and work practices would have to undergo change to accommodate a more hygienic way of working.

The track hopper dust control solution at Paradip Port is not about nozzles alone — which is what dust suppression is conventionally understood to be — but is instead about a combination of work practices and engineering for the complete strategy to be successfully implemented.

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PPT Chairman Rinkesh Roy checks for dust which is not found on the shirt of N. R. Bhoi, Supdt. Engineer (Projects) with the operation of F. Harley's DFDS System in the track hopper area during the First Trial Run on 2nd October 2018.

Most Valued Observation

"It WAS next to impossible to stand here," — Rinkesh Roy, Chairman, Paradip Port Trust