

Dust suppression hoppers reduce airborne respirable dust during bulk loading –

Before and after installation of the DSH System.



BACKGROUND

Whilst large amounts of anecdotal evidence exists regarding varying dust reduction methods, these have in the most part never been fully quantified. In 20014/15 a joint testing protocol was prepared between a major US sand company and NIOSH, part of the US Health and Safety Authority. They based their initial investigation on the industry standard handbook with IMA-NA, Chapter 7 – Bulk Loading.

A New Zealand company (DSH Systems Ltd) was identified in a literature search as potential dust control solution. There was limited data already collected from Australia and there were US companies with units installed which could be tested to prove effectiveness.

DUST SUPPRESSION HOPPER

The DSH Dust Suppression Hopper is designed to load product in a solid column, thereby reducing air in product and minimizing entrainment of dust.

The system eliminates the need to raise/lower the loading spout and it is equipped with a plug that prevents discharge until predefined quantity has accumulated.

Specialized springs or PLC system is used to control the discharge aperture to match hopper feed rate.

Two Case Studies were carried out.

Case study # 1

This plant loads open-bed truck on an intermittent basis

In 2013 – baseline conditions were sampled and the installation of a DSH system followed.

In 2014 – the installation was sampled twice to obtain test data.

Only fully loaded trucks were included in analysis

SAMPLING METHODOLOGY

Scientifically approved testing parameters were used and these included:

- ❖ Quantify respirable dust generation; not exposures
- ❖ Sampling packages located at four inside corners of bed
- ❖ Gravimetric and instantaneous, light-scattering samplers
- ❖ Samplers started just prior to loading and removed/stopped after each truck was loaded
- ❖ Four locations were combined to get average truck concentration

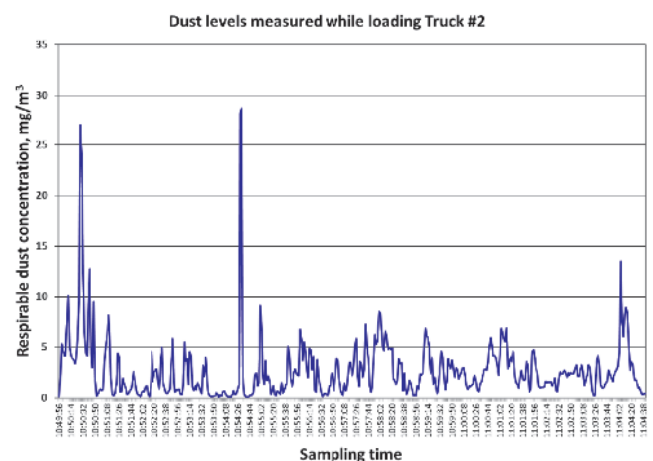


Sampling procedure.

- ❖ Short term sampling was used – 4 to 16 minutes to load a truck
- ❖ The tests utilized one set of gravimetric filters per sampling day
- ❖ The close proximity to loading resulted in elevated dust concentrations
- ❖ The researchers zeroed personal Data Ram (pDR) periodically

DATA ANALYSIS

- ❖ pDR data adjusted with gravimetric/pDR ratio
 - ratio = (avg grav conc) ÷ pDR conc
 - ratio calculated for each sampling location for each day of sampling
- ❖ pDR data from 4 locations used to calculate average concentration for each truck loaded

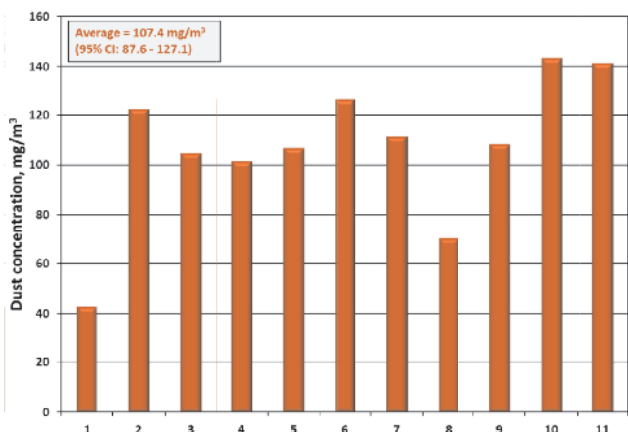
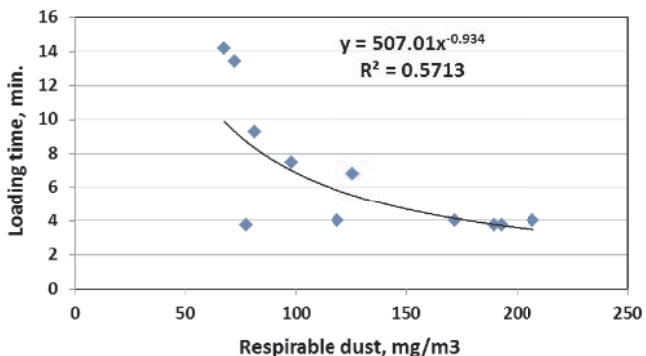


Two DSH Systems case Studies

DATA ANALYSIS - BASELINE

- ❖ Average loading time (alt) = 6.8 minutes
- ❖ Truck loading times (tlt) varied from 3.8 to 14.2 minutes
- ❖ The researchers were looking for any possible relationship between loading time and dust
- ❖ They then normalized the dust concentrations = (tlt/alt) x truck concentration

Impact of loading time on baseline dust



Normalized dust levels from baseline sampling

DSH INSTALLATION

- ❖ Multiple product silos were used to load trucks
- ❖ The customer added a bucket elevator to feed material to DSH
- ❖ All of the silos fed into bucket elevator system
- ❖ There was a more consistent but slightly slower feed rate when compared to loading during baseline

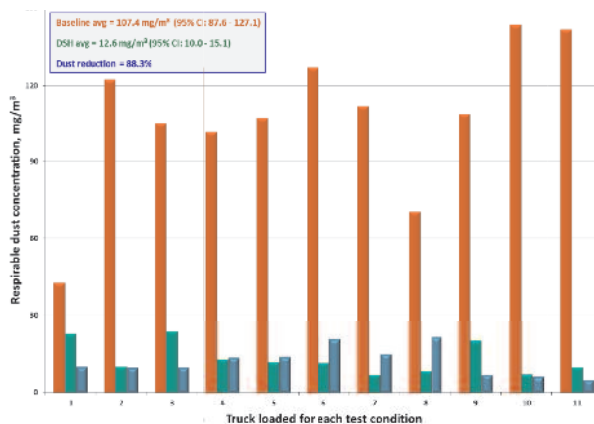


DSH installation and operation.

DSH SAMPLING

- ❖ July survey
 - 11 trucks sampled
 - 13.5 minute average loading >me

- 13.2mg/m³ average
- ❖ August survey
 - 11 trucks sampled
 - 13.8 minute average loading >me
 - 12.0mg/m³ average

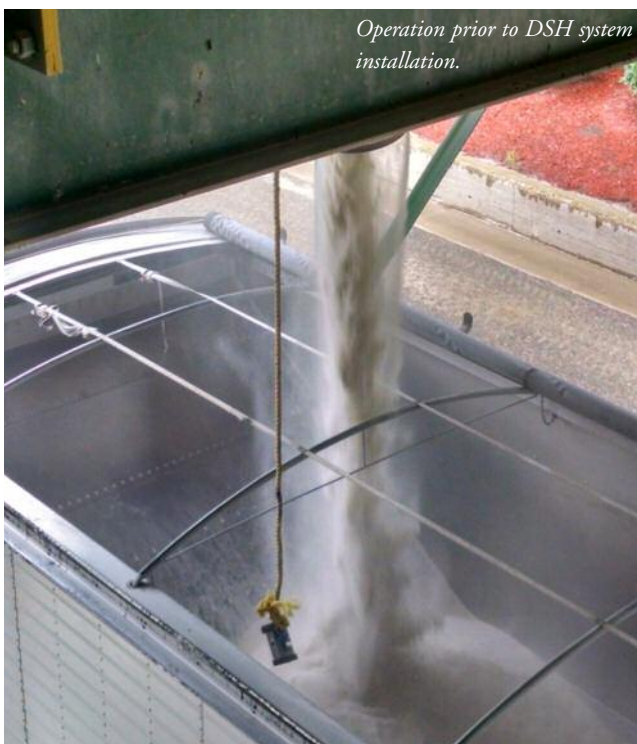


Dust levels from baseline and DSH sampling.

Case study # 2

This plant loads open-top trucks intermittently loaded throughout the day

- ❖ Baseline readings were taken few days prior to installation
- ❖ DSH installation took ~1 day
- ❖ Two trucks were sampled prior to install
- ❖ Two trucks were sampled post install



SAMPLING METHODOLOGY

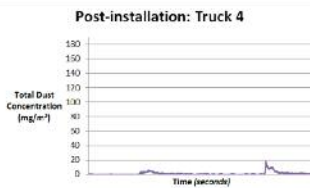
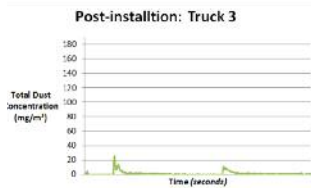
Scientifically approved testing parameters were used and these included:

- ❖ Quantify fugitive dust generation; not exposures
- ❖ Single direct-reading monitor (pDR) used, hung ~ 24 inches from column and ~8 inches below rim of trailer
- ❖ The sampler started just prior to loading, lowered and was



removed/stopped after each truck was loaded

- ❖ Testing was in a single location
- ❖ Full Data analysis was carried out after the test



Independently graphed data measuring Total Dust generated during open top truck loading before and after the installation of a DSH Hopper at the Ottawa, MN Plant using a pDR-100.



Before and after installation of the DSH System.

Conclusions

- ❖ The DSH system reduced respirable dust liberation by
 - 88% case study #1
- ❖ The DSH system reduced Total Dust
 - 98% case study #2
- ❖ The DSH system was seen to operate without major maintenance problems

Costs

The installed system as tested:

- ❖ ~\$20K for DSH
 - The value of dust control that this technology potentially brings for the minerals industry speaks for itself.

Whilst these tests were of truck loading applications, the DSH system has the same level of results whether loading trucks, trains, barges, ships or stockpiles. They are available of a variety of sizes to suit all applications.

Future Test

The customer and Authority hope to continue to evaluate the efficiency of the DSH systems with various field- installations.

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