# Dust Monitoring to Validate Car Dumper Fogging System Performance

**James Forrest**
Technical Director – Air Quality

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# Acknowledgement & respect

GHD acknowledges Indigenous peoples as Traditional Custodians of the lands where we conduct business. We honour their enduring strength, diversity, resilience, and deep connections to land, water, and culture, nurtured over countless generations. We pay our respects to Elders, past and present, who carry the memories, knowledge, and spirit of the lands on which we live and work.

# Presentation overview

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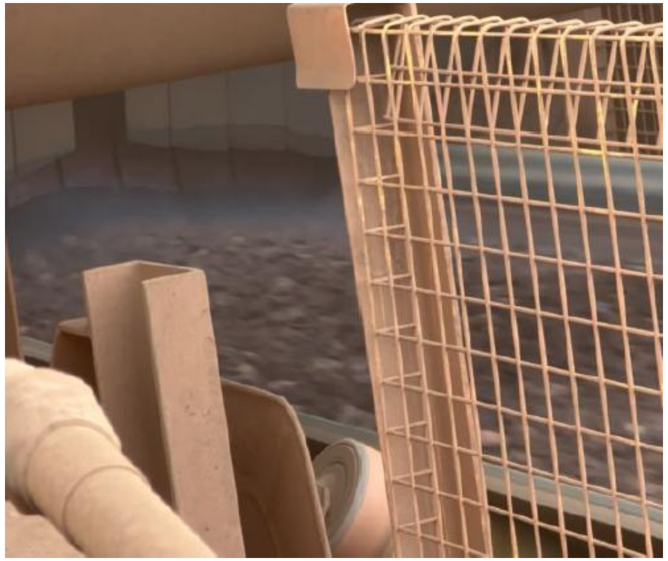
# Background & context

## BHP Nelson Point Operations

- Port Hedland bulk ore handling facility
- Train unloading, crushing, screening, stockpiling and ship loading
- Committed to ongoing dust abatement
- Operations under Licence L4513/1969/18
- Licence requires dust control validation reporting

## Fogging System Installation

- Discharge conveyor fogging systems at CD1 and CD3
- Located within tunnel, just before exit
- After bulk ore conditioning (BOC) sprays
- Fogging logic: first 65 ore cars ON, then OFF
- Triggered at >650 t/hr on belt weightometer
- Dust collectors also installed (wet scrubbers)



# Monitoring methodology

## Equipment

- TSI DustTrak DRX with heated inlets
- $PM_{10}$ configuration
- 1-minute averaging (1-second sampling)
- Zero calibration units fitted
- Mains powered — No data gaps

## Locations

- Car dumper 1: P2 conveyor tunnel exit
- Car dumper 3: P350 conveyor tunnel exit
- Immediately downstream of fogging system
- As close as practicable to the dust plume
- Remaining outside the restricted conveyor belt safety guard area required by site safety procedures
- Closest onsite met/dust monitor: Met data and background dust levels

**57 days**

Monitoring duration

**25 Sep – 21 Nov 2024**

Campaign period

**7 products**

Ore types sampled

# Data analysis approach

## Inclusion criteria for rake assessment

1

**Fogging operation**

Continuous operation of fogging system for at least 20 minutes (both ON and OFF)

2

**Conveyor operation**

Continuous conveyor operation for at least 20 minutes with ore on belt

Mitigate influence of recirculation due to conveyor starts/stops

3

**Wind conditions**

Favourable and consistent wind speed and direction to keep monitor within plume

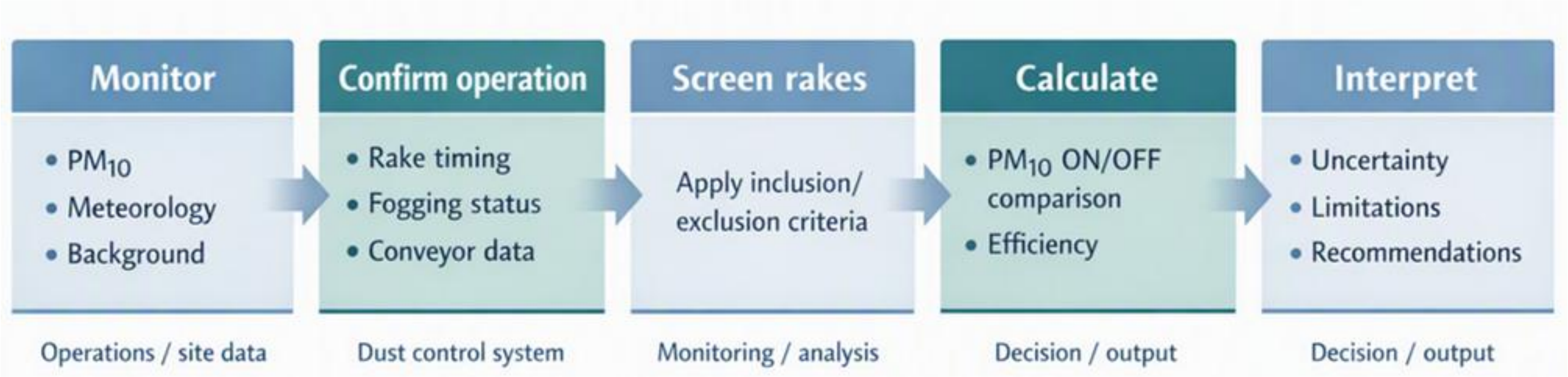
4

**Background dust**

No influence from background dust concentrations at nearby onsite monitor

# Data analysis approach

## Five-stage workflow for validating dust control



# Dust reduction methodology

## Dust control efficiency calculation

**Dust control efficiency (%) =**

$$(C \text{ average fogging OFF} - C \text{ average fogging ON}) \ / \ C \text{ average fogging OFF} \times 100$$

## Fogging operation logic

Fogging ON for first 65 ore cars of rake, then automatically OFF

Provides within-rake comparison (same product, same conditions)

Water flow data confirms ON/OFF status

Air flow data used where water flow meters were erroneous

# Car dumper 1 — Results summary

**39%**
Avg reduction (excl. Fines 4)

**376**
Total rakes monitored

**77**
Assessed rakes

| Product | Rakes | Assessed | Avg reduction |
|---|---|---|---|
| Fines product 1 | 72 | 12 | **35%** |
| Lump product 1 | 16 | 4 | **42%** |
| Fines product 2 | 115 | 31 | **47%** |
| Lump product 2 | 48 | 14 | **36%** |
| Fines product 3 | 83 | 9 | **35%** |
| Lump product 3 | 29 | 6 | **41%** |
| Fines product 4 | 13 | 1 | **12%** |

# Car dumper 3 — Results summary

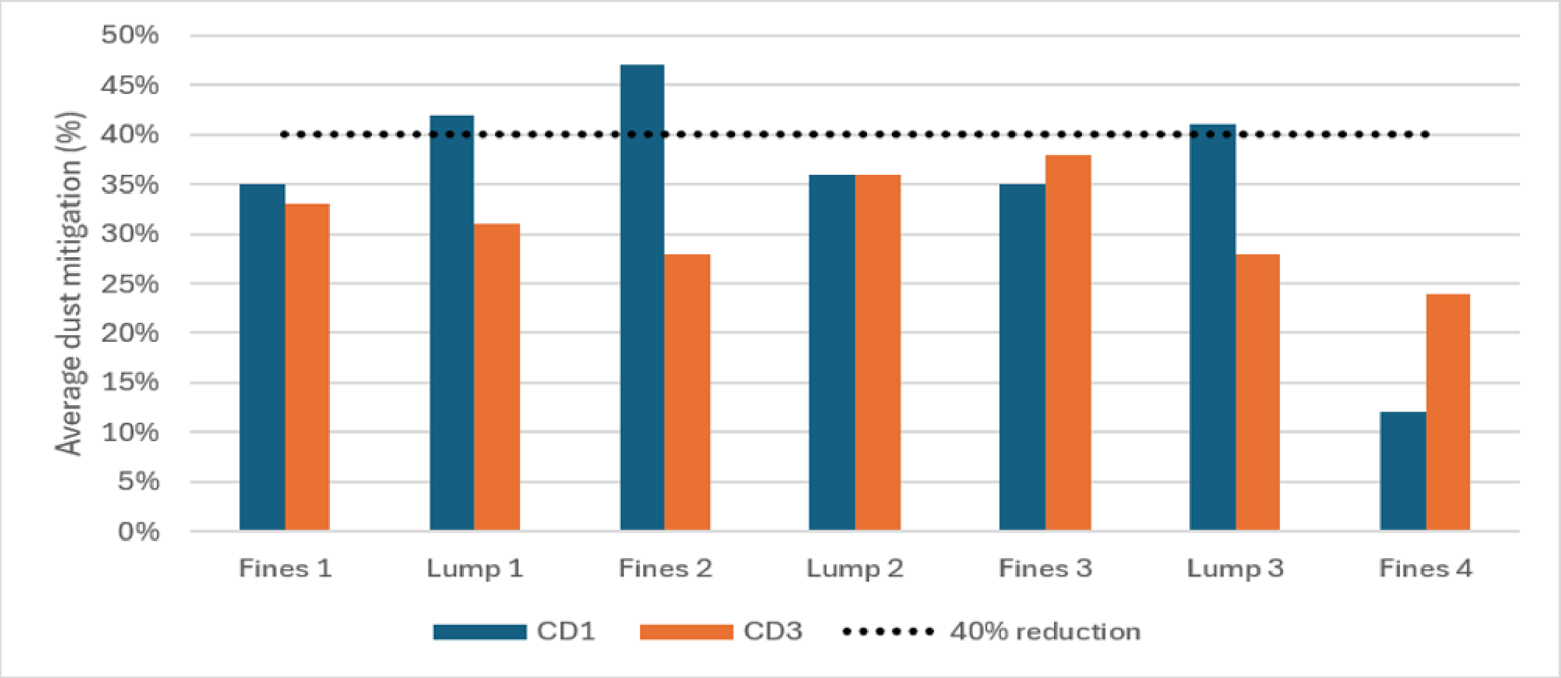
**33%**
Avg reduction (excl. Fines 4)

**355**
Total rakes monitored

**60**
Assessed rakes

| Product | Rakes | Assessed | Avg reduction |
|---|---|---|---|
| Fines product 1 | 48 | 6 | **33%** |
| Lump product 1 | 27 | 7 | **31%** |
| Fines product 2 | 115 | 21 | **28%** |
| Lump product 2 | 67 | 8 | **36%** |
| Fines product 3 | 59 | 14 | **38%** |
| Lump product 3 | 33 | 3 | **28%** |
| Fines product 4 | 6 | 1 | **24%** |

# Average dust mitigation reduction



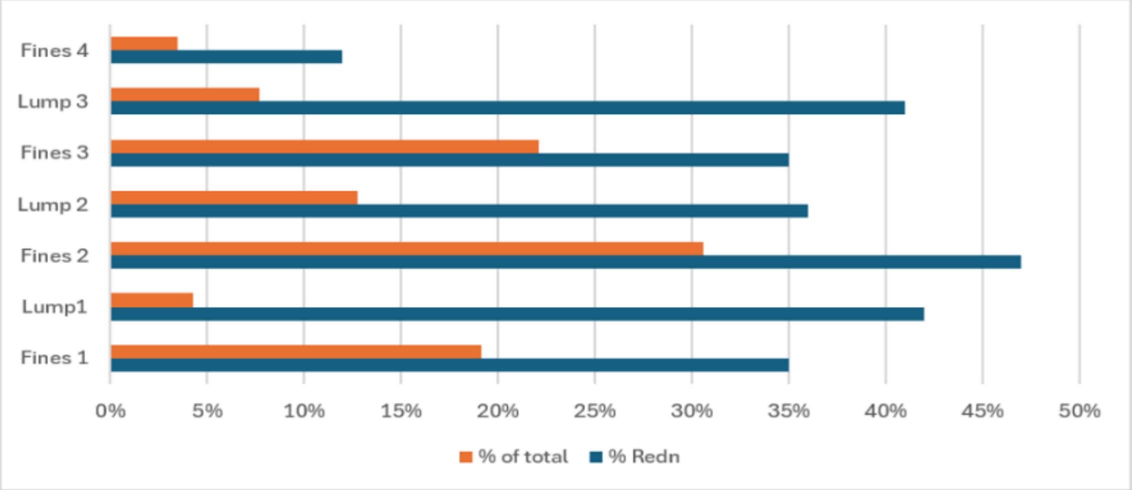

- Fogging systems demonstrate measurable dust reduction at both car dumpers
- CD1 average 39% reduction; CD3 average 33% reduction (excluding Fines 4)
- Multiple individual products demonstrate ≥ 40% reduction — Supporting target performance

# CD1 vs CD3 — Comparative performance

## Car Dumper 1

**39%**
average reduction (excl. Fines 4)

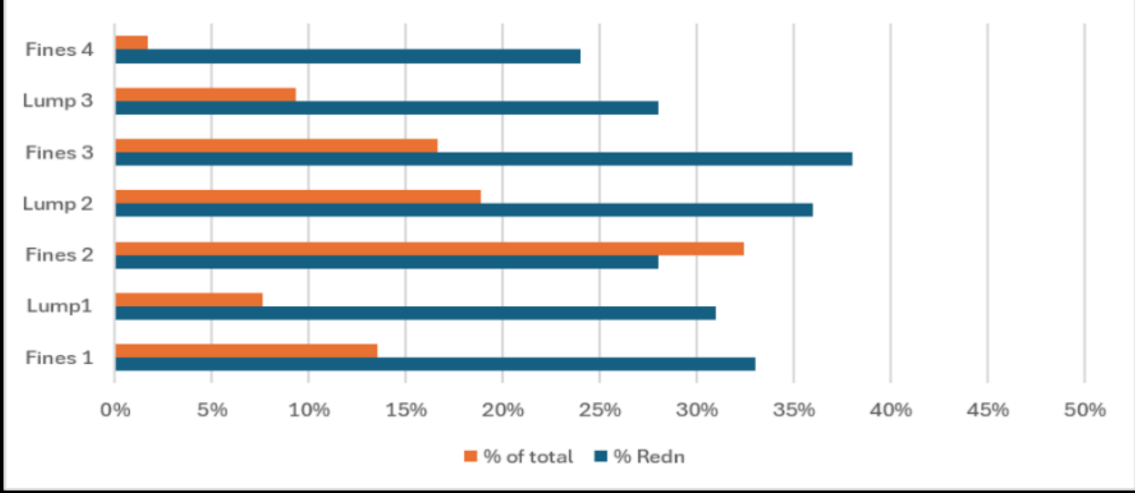
97% of products at ≥ 35% reduction




## Car Dumper 3

**33%**
average reduction (excl. Fines 4)

98% of products at ≥ 28% reduction



# Challenges & confounding factors

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### Irregular operation

Car dumpers and conveyors running irregularly during normal operations, limiting continuous sample availability

W

### Wind variability

Changes in wind speed and direction causing monitors to move in/out of the dust plume during rakes

F

### Water flow meters

Erroneous water flow data from one or both circuits requiring use of air flow data as backup

V

### Data variability

High variability in dust concentrations across samples, with ±30% estimated measurement uncertainty

B

### Background sources

Potential influence from nearby operations requiring monitoring and exclusion of affected periods

T

### Timing constraints

Requirement for 20+ minutes of consistent ON/OFF operation limiting assessable rakes

# Implications & considerations

## Monitoring design

Within-rake ON/OFF comparison is effective

20-minute minimum criterion is appropriate

Multiple confounding factors require large sample sizes

Complete data capture (no gaps) essential

## Operational insights

Fogging complements existing controls (BOC + dust collectors)

Higher moisture products show lower fogging benefit

Lump products generate highest concentrations

System logic integration (>650 t/hr trigger) works well

## Measurement uncertainty

Inherent uncertainty in measurement data is an important consideration when evaluating control efficiency.

An uncertainty allowance of +/-30% was applied to account for instrument accuracy and additional operational and environmental variability.

**The presence of this uncertainty does not invalidate the results; rather, it defines the confidence with which each result should be interpreted.**

# Conclusions

Fogging systems demonstrate measurable dust reduction at both car dumpers

CD1 average 39% reduction; CD3 average 33% reduction (excluding Fines product 4)

Multiple individual rakes demonstrate ≥ 40% reduction — Supporting target performance

**The most robust conclusion is therefore not that each product achieved a precise percentage reduction, but that the screened data show repeatable and measurable reductions at both car dumpers.**

Variability in results reflects complex dust source nature and confounding factors.

CD1 vs CD3 difference attributed to physical location characteristics, not system performance.

Fogging provides additional control beyond existing BOC sprays and dust collectors

**Variation in measured effectiveness likely due to complex dust source nature and difficulty isolating confounding factors, rather than fogging system performance differences.**

# Acknowledgements

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# ✱ Thank you