Department of Mineral Resources
New South Wales

Coal Mining Inspectorate and Engineering Branch

NEW SOUTH WALES STONEDUST AUDIT

REPORT TO INDUSTRY

MDG 1008

SEPTEMBER 1996

NEW SOUTH WALES
STONEDUST AUDIT

REPORT TO INDUSTRY

MDG 1008

SEPTEMBER 1996

SUMMARY

This report provides feedback to industry on key areas of Stonedust programs as practiced in New South Wales coal mines.

The report has found that few mines employ quality management techniques to implement and control their Stonedusting and Sampling Rules. In particular, there is an absence of tangible outcomes expected of stonedusting programs as well as a failure to monitor/measure actual system performance against expected performance. The report has found that continuous improvement, via time based reviews of stonedusting programs, is not being widely practiced.

To aid Managers design more effective stonedust programs various benchmarks for:-

- Stonedust application,
- Measurement criteria, and
- Management standards

have been provided.

All benchmarks recommended have been based directly upon industry performance at the time of data collection.

All benchmarks are minimum standards.

INDEX

PAGE

1.0 INTRODUCTION

During 1995 a desktop audit was conducted into stonedusting practices and standards for underground coal mines in New South Wales.

The audit, which was an element of a broader review into the adequacy of stonedusting, was conducted to:-

i) determine a baseline database for future comparison purposes,
ii) determine benchmarks for guidance to industry on acceptable standards and
iii) to identify which elements of stonedust management programs required enhancing.

The audit commenced on the assumption that implementation of Stonedust and Sampling Rules (required by the Coal Mines Regulation Act) needs to be carefully managed by utilizing appropriate quality management techniques. The audit document is displayed in Appendix 1.

This report delivers findings in 3 key areas of systems performance namely:-

i) Systems Outcomes
ii) Systems Standards
iii) Systems Management.

2.0 SYSTEM OUTCOMES

Sampling is required under legislation (Appendix 2) in order to measure the effectiveness of stonedust application. Therefore the percentage of failed samples, on an annual basis, is a convenient and meaningful measure of system effectiveness.

a) Finding

In a one year period 10,020 samples were taken of which 572 failed. This represents a failure rate of 5.7% on an industry basis.

Comment

Unfortunately not all audit returns were fully completed, despite follow-up action, with some collieries failing to provide the necessary data.

Given this position it is considered prudent to round the industry average sample failure rate to 6.0%.

When considering which statistical criteria should be employed as a measure of scatter, the use of a median value and quartile ranges was considered. The median for the samples taken was 4.5% but unfortunately the scatter of results was so wide that division of "above" median distribution into quartile ranges would not have effectively represented the non-performance of some collieries in regards to system outcomes.

Figure 1 illustrates outcome scatter with respect to a 6% failure average.

It must be noted that one colliery recorded a failure rate of 75%. This result was considered so deviant as to be dealt with separately from this study.

Sixteen mines exceeded the average, some by a narrow margin others by significant amounts. In determining which performance constituted an unacceptable outcome, a failure rate of twice the industry average was adopted. This failure rate corresponded exactly with the worst 20% of outcomes. Therefore sample failure rates above 12% constitute a measure for unacceptable performance.

Collieries with outcomes >6% but ≤12% are not unacceptable but are on the wrong side of average and represent a concern. Those closer to 12% constitute mines where systems outcomes may well become unacceptable unless effort is made to improve the system. Quantifying this area of concern is somewhat subjective, however a lower value of 8% for failures is arrived at if the worst 35% of collieries are considered.

BENCHMARK

It is recommended that industry implement the following benchmarks as measures of stonedust systems effectiveness:

- **AVERAGE INDUSTRY FAILURE RATE - 6% of samples taken**
- **AREA OF CONCERN FOR SYSTEM EFFECTIVENESS - failed sample rate lies in the range ≥8% to ≤12%**
- **UNACCEPTABLE SYSTEM EFFECTIVENESS -failed sample rate exceeds 12%**

Refer to Figure 2 for graphic representation of results

3.0 SYSTEM STANDARDS

The following matters were selected to determine if stonedusting programmes included activities essential for a managed system to succeed. These topics include both underpinning and applied standards.

a) Finding

- Only 42% of collieries provide a statement of duties to their roadway dust officers.
- Only 45% of collieries claim to have conducted recent training for their roadway dust officers.

Comment

There was a strong correlation between mines that did not provide a statement of duties and those that did not train their personnel. Mines without these measures tended to have sample failure rates above the industry average.

BENCHMARK

It is recommended that all collieries provide their roadway dust officers with:-

- a complete statement of duties, and
- a comprehensive training package associated with those duties.

b) Finding

The stated rate of stonedust application, as required by statute, ranged from 1.33 kg/m to 40 kg/m. The following values were determined from the stated rate of stonedust application.

All mine average - 12.7 kg/m
Class A mine average - 16.0 kg/m
Class B mine average - 10.0 kg/m

However, when these stated application rates were measured against colliery failed sample performance the following findings were made:

Mines with a failure rate of ≥8% had an average stated stonedust application of 11 kg/m

Mines with a failure rate of <6% had an average stated stonedust application of 12 kg/m

Comment

There is no correlation between statutorily required standards for stonedust application and the effectiveness of the stonedust system as measured by sample failure percentage.

It is apparent that system effectiveness is more a measure of commitment shown at all levels by colliery personnel than unrealistic or non-managed stonedust application rates.

c) **Finding**

For longwall mines implied stonedust application rates necessary to maintain a sample failure rate of ≤6% were:-

- CLASS A MINES - 40 kg/m minimum
- CLASS B MINES - 20 kg/m minimum

Comment

The results relate to the absolute minimum of stonedust to be applied in the return per metre of face retreat. Rates apply for face widths of 180m and seam height of 3m.

Provision of a stonedust application rate to longwall returns is not a statutory requirement. Only 32% of longwall mines in the state proclaim such an application rate. There is a strong correlation between these stated standards and an acceptable sample failure percentage.

BENCHMARK

It is recommended that industry implement the following stonedust application rates for all longwall faces (adjusted accordingly for face width and seam height):-

- CLASS A MINES - 40 kg/m of wall retreat (as a minimum)
- CLASS B MINES - 20 kg/m of wall retreat (as a minimum)

d) **Finding**

For production faces ventilated by auxiliary fans the implied application rates necessary to maintain a sample failure rate of ≤6% were:-

- CLASS A MINES - 175 kg/shift minimum
- CLASS B MINES - 120 kg/shift minimum

Comment

The results relate to an absolute minimum of stonedust to be applied per production shift.

Provision of a stonedust application rate to auxiliary fan returns is not a statutory requirement. Only 58% of auxiliary fan production faces proclaim such an application rate.

BENCHMARK

It is recommended that industry implement the following stonedust application rates for all auxiliary fan production faces:-

- CLASS A MINES - 175 kg/shift (as a minimum)
- CLASS B MINES - 120 kg/shift (as a minimum)

e) **Finding**

62% of mines sample belt roadways more frequently than other roadways. This percentage drops to 50% for Class A mines. Only 40% of mines sample intake belt transfer points regularly. Of these 40% of mines, one third only sample annually.

Comments

Despite use of traditional dust suppression measures, belt conveyors and particularly transfer points, create copious quantities of float coal dust. Fine deposits of this dust negate the effect of even rigorous applications of stonedust. Float dust, if suspended in the correct concentration, is explosive.

Float dust accumulation generated by belt conveyors is not systematically nor effectively managed by the industry.

BENCHMARK

It is recommended that the float dust hazard associated with belt conveyors be quantified by having:-

- All mines (irrespective of class type) sample belt conveyors at a frequency greater than for any other roadway.
- All mines sample conveyor transfer points at least twice annually.

RECOMMENDED ACTION

It is recommended that industry implement measures to effectively neutralize deposits of float dust that may accumulate in coal mines.

f) **Finding**

49% of all mines have belt conveyors in return airways. This level rises to 70% for Class A mines. Only 30% of mines with belts in the return specify additional measures to address the potential hazard of float dust.

Those mines that specify additional measures require stonedust to be applied to return air, by trickle dusters, at 400m intervals. No application rate, stated or implied, could be determined.

Comment

The generation of float dust from belt conveyors in return roadways increases the explosion hazard in coal mines unless that dust is effectively neutralized. It must be noted that the lower explosive limit for methane is markedly reduced in the presence of suspended coal dust. Even a 2% methane/air mixture can be explosive. Refer to figure 3.

BENCHMARK

It is recommended that mines installing belt conveyors in return airways, introduce adequate quantities of stonedust (via trickle dusters) into the main body of the return air at intervals not exceeding 400m. It is recommended that these applications of stonedust occur whilstever belt conveyors are operational.

g) **Finding**

Only 3 mines in New South Wales employ full-time roadway dust officers. These 3 mines have the lowest sample failure rate in New South Wales.

66% of all mines dedicate 1 day or less per week to management of the roadway dust program.

Comment

There is a strong correlation between sample failure rates at a mine and the time dedicated per week to roadway dust management. Of those mines dedicating 1 day or less per week to roadway dust management a surprising number are large producers of coal and are physically large mines.

Annual Tonnage	No. of Mines	Classification
<500,000	13	SMALL
500,000 - 1,000,000	5	MEDIUM TO LARGE
1,000,000 - 2,000,000	7	LARGE

Dedication of 1 day or less per week to roadway dust management in large mines appears at odds with the potential coal dust hazard associated with high production outputs.

BENCHMARK

It is recommended that all large mines employ full-time roadway dust officers and all other mines increase the time dedicated per week to management of their roadway dust program to 2 days as a minimum.

4.0 SYSTEM MANAGEMENT

The following matters were selected as indicators of a systems attention to detail as well as overall quality control.

a) Finding

- Only 40% of mines employed an independent laboratory to prepare standard stonedust colour samples.
- 38% of mines had standard samples more than 12 months in age.

Comment

Statute requires annual preparation of standard colour samples, by an independent laboratory.

BENCHMARK

It is recommended that all mines maintain full compliance with statutes regarding the preparation of standard colour samples.

b) Finding

Only 27% of mines make provision for replacement of roadway dust officers during absences exceeding 5 days duration. Failure to do so placed four of these mines in breach of their own Stonedust and Sampling Rules.

BENCHMARK

It is recommended that all mines make provision for replacement of roadway dust officers, by qualified and trained persons during absences exceeding 5 days.

c) Finding

Mines that collected the full complement of roadway dust samples required by their Rules had sample failure rates below the industry average. Mines that collected less than 95% of the complement of roadway dust samples required by their Rules had sample failure rates above the industry average.

BENCHMARK

It is recommended that all mines collect the complete number of roadway dust samples required by their Stonedust and Sampling Rules.

d) **Finding**

Responsibility for implementing and maintaining face stonedust standards was divided amongst colliery officials as listed:-

Official Responsible	% of Mines
Solely Deputy	62
Deputy and Shift Undermanager	16
Solely Shift Undermanager	7
Solely Undermanager-in-Charge	8
Other official, e.g. Safety Officer	7

Comment

Those mines with the lowest sample failure rates had two layers of officials responsible for face stonedust standards, namely the Deputy and Shift Undermanager.

Those mines with the highest sample failure rates had only one layer of officials responsible for maintaining face stonedust standards. In these cases the responsible official was also remote from the face.

BENCHMARK

It is recommended that responsibility for implementing and maintaining face stonedust standards rest primarily but not solely with the face deputy. A parallel but secondary responsibility needs to rest with the shift undermanager who should have an audit/overview role.

e) **Finding**

No correlation exists between the length of time sampling records are kept and sample failure rate. Not one mine utilized records of sample results as a systems improvement tool.

BENCHMARK

It is recommended that all mines utilize data obtained from system record keeping as a management tool to monitor system performance with the aim of continual improvement.

f) **Finding**

Only 13% of mines conducted meaningful, time based reviews of their stonedust systems performance and outcomes.

BENCHMARK

It is recommended that all mines implement quality management techniques to control their Stonedust and Sampling Rules.

APPENDIX 1

AUDIT of EXPLOSION BARRIERS and STONEDUST

1. General Information

1.1 Name of Mine:

1.2 Please nominate a mine employee who can be contacted about this questionnaire:

Name

Position

Telephone No. (and contact hours)

1.3 Seams worked, and classifications

	Seam 1	Seam 2	Seam 3	Seam 4
Name of Seam				
Classification (A or B)				
If Class A: approx. gas content of coal				
If Class A: approx. composition of seam gas				

2. Stonedust Sampling

2.1 Sampling methods

Which of these sampling methods do you use in your mine? (please circle)

Spot

Strip

Visual

2.2 Equipment used

2.3 Please specify Location of sampling

2.3.1 Zones

What classes of sampling zones exist in the mine?

2.4 How are these zones defined?

Frequency of sampling

Do you have a sampling schedule?

If so, please specify.

If not, how is the frequency of sampling determined?

2.5 Testing of samples

2.5.1 Which of these method(s) do you use for testing samples? (please circle)

Chemical (ashing)

Volumetric

Gamma-ray backscatter

Colour

2.5.2 When do you use each of these methods?

- Chemical (ashing)
- Volumetric
- Gamma-ray backscatter
- Colour

2.5.3 If you use the colour method for testing:

Who does the testing?

How are your standard samples prepared, and by whom?

How many samples taken yearly? ( )

How many failed samples yearly? ( )

When were your standard samples last prepared?

2.5.4 If you use other methods for testing:

Who does the tests?

How do you determine that the tests are in accordance with the approved method?

3. Roadway Dust Samplers

3.1 Who is/are the appointed person(s)?

What qualifications does the roadway dust sampler have?

What experience does the roadway dust sampler have in this work?

3.2 *Training*

When was the last time your roadway dust sampler(s) was/were trained?

What is the time interval between training and re-training?

Who conducts the training sessions?

Who trains the trainer?

3.3 *Work availability:*

What proportion of the working week is dedicated for roadway dust sampling and testing?

What provision is made for replacement of the roadway dust sampler when he is absent (e.g. on leave)?

3.4 *Supervision*

Does the roadway dust sampler have a statement of duties?

- if so, please attach a copy

if not, what are his duties?

Who supervises the roadway dust sampler?

To whom does the roadway dust sampler report a failed sample?

4. Face Dusting

What is the maximum length of roadway at a face which can remain un-dusted at your mine?

For what period of time can this remain un-dusted?

Do you have any exemptions which permit you not to stonedust certain lengths of roadway at all?

What rate of stonedust do you apply (e.g. kg/m of advance)?

What methods/equipment do you use?

What measures do you use to protect the face area between applications of stonedust?

Who is responsible for maintaining the necessary standards of explosion protection in the face area?

5. Immediate Returns

What measures do you use to ensure that the immediate return roadways do not become places containing dangerous dust?

What equipment is used to achieve this?

If your mine operates a longwall, what methods do you use to treat the coal dust generated on the face as it enters the immediate face return?

Is a rate of application of stonedust specified? If so, how much?

Who is responsible to ensure that this operates effectively?

How does this person assess that the equipment is operating effectively?

6. Conveyor Belt Roadways

6.1 Belts In Intakes

What measures do you take to reduce the production of dust generated from transport of coal on conveyor belts?

What special precautions are taken at:

- transfer points?

- belt driveheads?

- loading points?

What equipment is involved in this control of dust?

Are belt roadways sampled at a different frequency from other roadways? If so, please specify.

6.2 Belts In Returns

Do you run any conveyor belts in return roadways? [If NO, go to the next section.]

What extra measures - additional to those in the section above ('belts in intakes') - are taken in these roadways? (Please describe these in detail.)

Who is responsible for ensuring that these measures are being maintained?

7. Outbye Roadways

When is supplementary stonedusting initiated:

- on outbye intake roadways?

- on outbye return roadways?

8. Underground Bins

Do you have an underground bin? [If NO, please go to the next section?]

What measures are used to treat coal dust generated in the operation of the bin?

How often are samples taken to determine the effectiveness of these protective measures?

9. Auxiliary Fans

Do you use auxiliary fans for face ventilation? [If NO, please go to the next section?]

How do you treat the coal dust issuing from the fan exhaust?

What quantities of stonedust are used?

What type of equipment is used?

10. Barriers

Do you use explosion barriers (either water or stonedust) in your mine?

Where are they located, and what types are used in each location?

Who decides on the location and type of barriers to be installed (e.g. water/stonedust/concentrated/distributed)?

Do you have copies of the current approvals for the types of barrier you are using?

If you have these, please provide a copy of each current approval.

Who calculates the quantity of water or stonedust and the layout of the barrier, and how does he determine these?

What training and qualifications does this person have for this task?

Who is responsible for the erection of the barriers?

Who is responsible for inspecting the barriers?

Who is responsible for maintaining the barriers?

How do you ensure that the barriers are constructed in accordance with the conditions of approval?

Please provide a plan of the physical construction of each type of barrier you use.

How do you determine that the barriers continue to comply with the original specification?

Is each barrier accompanied by a notice detailing its specification?

How is the person responsible for maintaining the barriers informed of defects requiring attention?

11. Documentation

How are sampling results recorded?

When are results recorded?

Who records them?

Where are the records kept?

For how long are the records kept?

Do records include the results of visual observations?

Are the records counter-signed, and by whom?

What is the purpose of counter-signing?

How frequently are they counter-signed?

What records are kept of:

- installation of barriers?

- inspection of barriers?

- repairs to barriers?

12. Remedial Action

If a roadway dust sampler determines that a sample has failed:

- when does he report the failure for remedial action?

who is responsible for authorising remedial action?

- when is remedial action conducted?
- what priority is placed on remedial action?
- does the priority vary with the location within the mine?
- how do you confirm that the remedial action authorised has been carried out?
- is the sampler notified that remedial action has been taken, and who notifies him?
- how do you determine that remedial action has been effective?

13. Internal System Review

Are the Manager's Rules for stonedusting and sampling reviewed regularly?

If so, how often?

When were they last reviewed?

Who conducts the review?

Please provide a copy of the latest version of the Manager's Rules for stonedusting and sampling.

How do you establish that the Manager's Rules for stonedusting and sampling are effective in maintaining statutory standards in the mine?

APPENDIX 2

PART VI.

STONEDUSTING AND SAMPLING RULES.

Rules for stonedusting and sampling.

23. **(1)** The manager of a mine shall make rules with respect to stonedusting and sampling at the mine.

(2) Rules referred to in subclause (1) shall include provisions relating to the following matters:—

(a) the quantity of stone dust to be used per metre of advance at each working place;

(b) the method by which the area being advanced at each place is to be maintained in a safe condition in respect of dangerous dust between required applications of stone dust;

(c) the method by which stone dust is to be introduced at a convenient place near the working face so as to ensure that the immediate return airway does not become, or continue to be, a place containing dangerous dust;

(d) the procedures for and the frequency of the examination and sampling of roadways within face zones and in other parts of the mine to identify any place which is likely to be a place containing dangerous dust;

(e) the procedures for the retreatment of roadways in the various parts of the mine, with particular reference to conveyor belt roadways;

(f) the procedures for the making and keeping of reports of examinations and sampling of roadways and testing of samples.

FIGURES

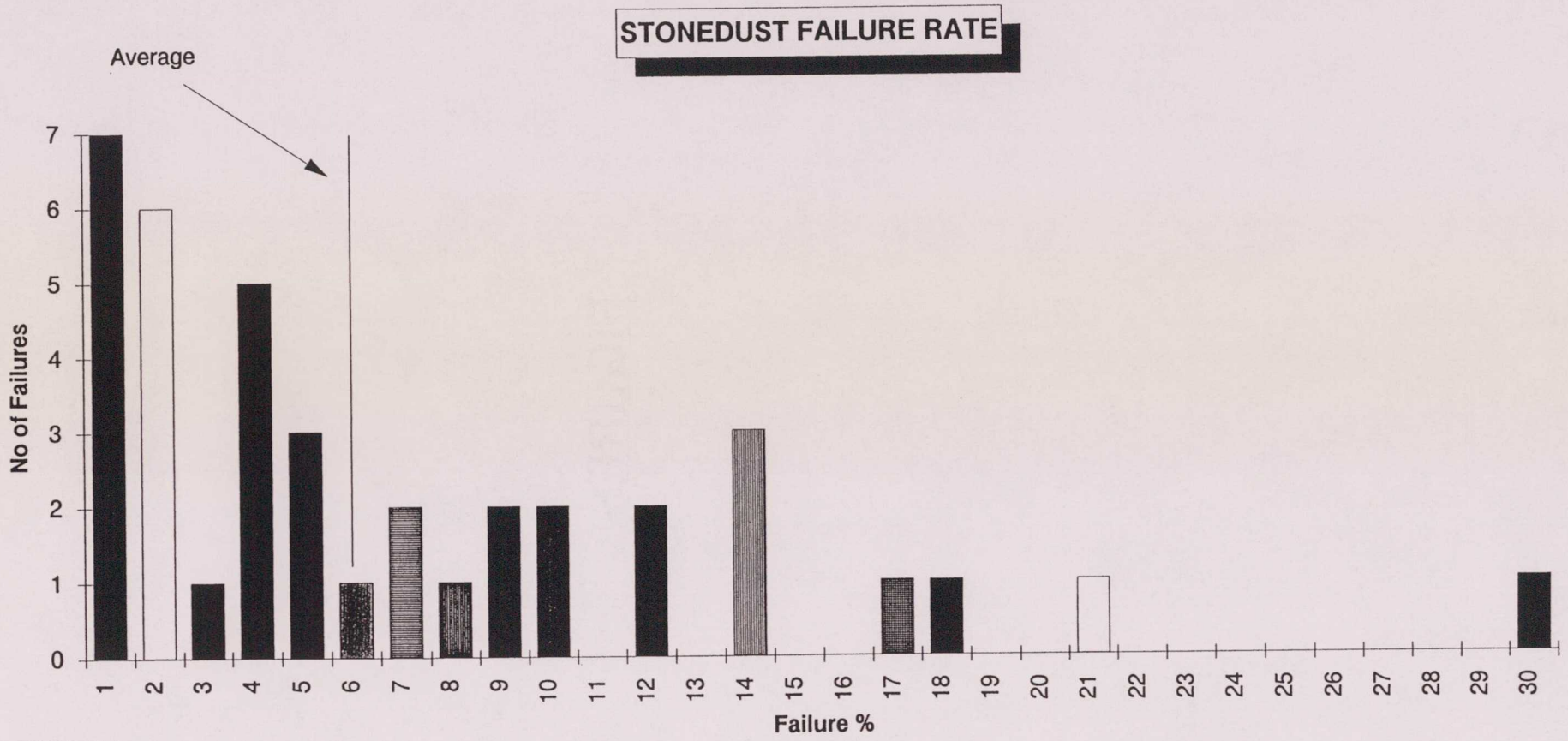
STONEDUST FAILURE RATE
Average
No of Failures
0
1
2
3
4
5
6
7
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
Failure %

FIGURE 1

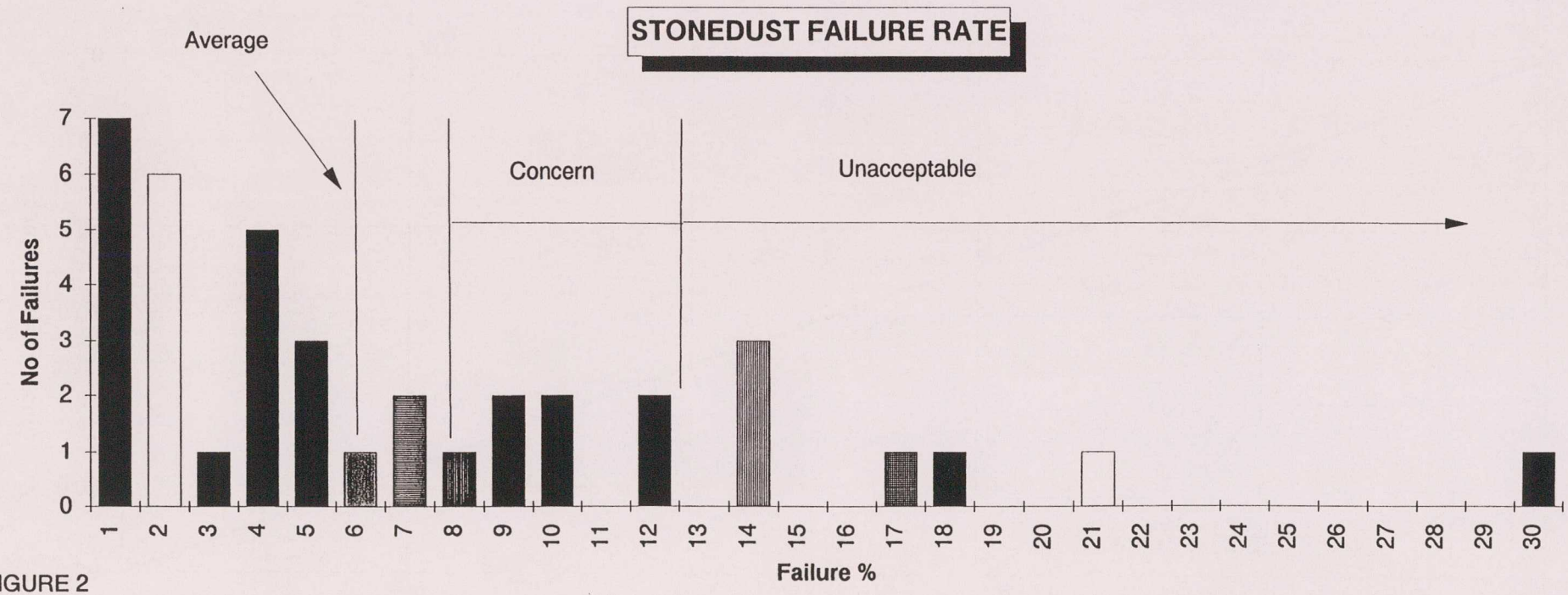
STONEDUST FAILURE RATE
Average
Concern
Unacceptable
No of Failures
0
1
2
3
4
5
6
7
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
Failure %

FIGURE 2

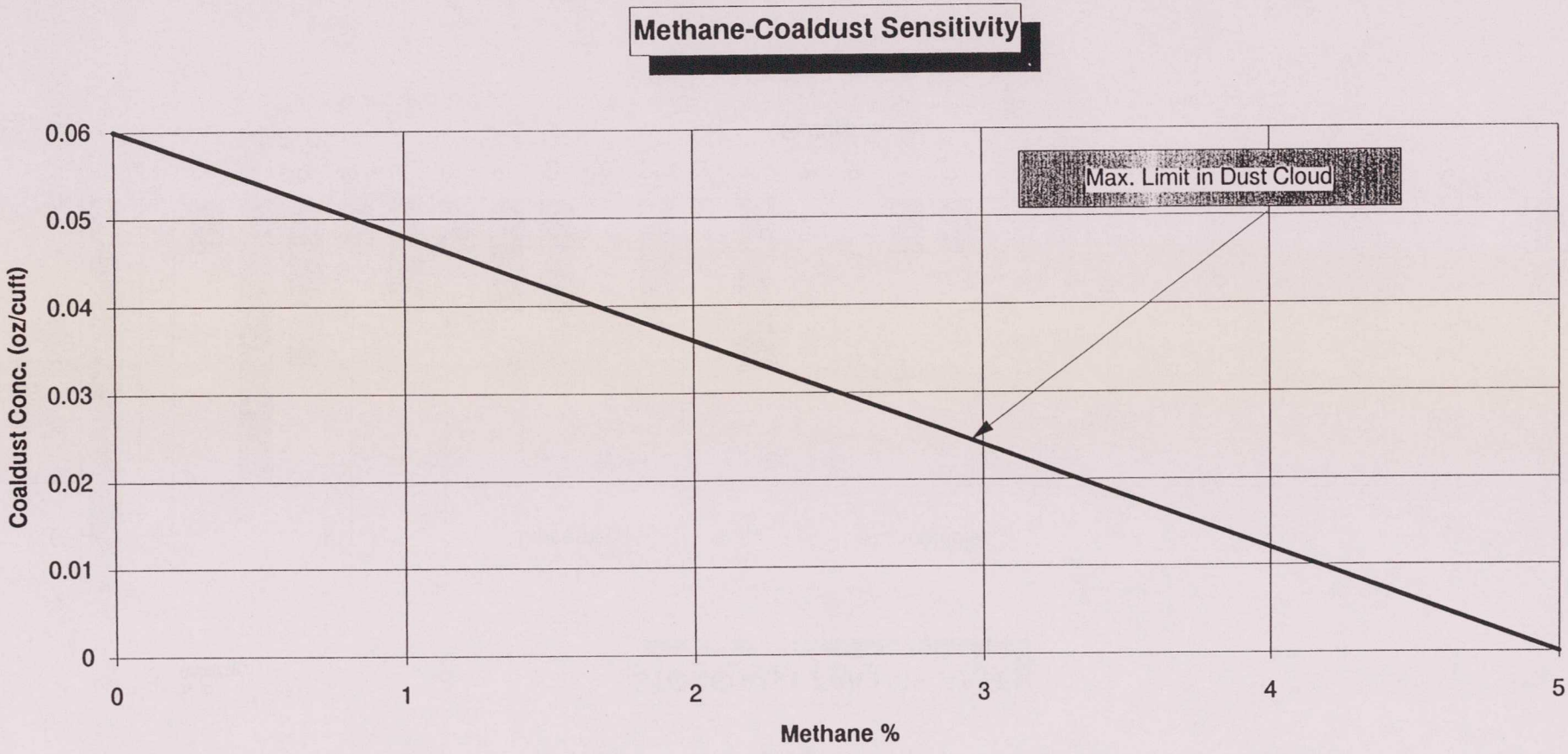
Methane-Coaldust Sensitivity
Max. Limit in Dust Cloud
Coaldust Conc. (oz/cuft)
0.06
0.05
0.04
0.03
0.02
0.01
0
0
1
2
3
4
5
Methane %

FIGURE 3