COAL DUST CONTROL

Recommended practices for loading, unloading and transporting coal by rail

Regional Report No. 86-17

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1.0 INTRODUCTION

Environmental concerns over fugitive emissions of coal dust during transport of coal by rail have been recognized since the introduction of large-scale export coal shipment. The concerns have been related mainly to nuisance soiling caused by the deposition of coal dust on properties adjacent to the rail corridors. To alleviate these concerns, a number of practices considered reasonable and practical are recommended in this document.

The Recommended Practices have no legal status. They are intended to provide guidance to the mining, handling and transportation sectors of the coal industry in Western Canada on the design and operation of dust control systems for loaded and empty trains. Many of the measures have already been implemented by some of the companies. Other companies and new coal producers are encouraged to adopt the practices presented herein.

Proper implementation of the recommendations should achieve effective coal dust control and minimize environmental impacts. In the event of any exceptional coal dust problem at any location along a rail route, control measures beyond those identified here may be imposed by the regulatory authorities. Additional mitigation measures will be determined on site specific factors after consultations with the companies involved.

This document has been developed with the assistance of a federal-provincial-industry Technical Review Group formed in 1984. The first task of the group was to review a draft background report titled *"Report on the Emission Control of Fugitive Coal Dust from Coal Trains."* (Environmental Protection Service, 1984) and to endorse its publication. That report provided detailed information on various aspects of the problem and lists available control technologies.

The Recommended Practices emphasize a specific dust abatement measure for loaded trains, namely the application of chemical dust suppressants, as the best practical technology currently available. Because industry and government continue to evaluate new methods and to make improvements, it is recognized that future experience may require changes to these practices.

BACKGROUND INFORMATION

2.0

2.1

Coal production and transportation

(Background Report: Sections 3.2 and 3.3)

The major coal exporting areas in Canada are located in the northeast and southeast regions of British Columbia and western Alberta. Other deposits, which supply mainly domestic markets, are mined in Nova Scotia, New Brunswick and Saskatchewan.

The coal exported from western Canada is shipped to three tidewater terminals in British Columbia, located in the northern and southern areas of the province. Long transportation distances, (exceeding 1,100 kilometres) present a considerable challenge to developing effective dust control measures.

Coal for export is usually processed at the mine site using conventional coal preparation metnod The clean wet coal is thermally dried to a moisture content of 8% or less prior to shipment by train. Most of the dried coal is stored in covered sheds or silos located at the train load out facility. The moisture content of the coal reflects customer specifications and minimizes handling and shipping problems.

2.2

Train operations

(Reference Section 3.1)

Each coal train in western Canada consists of approximately 100 open-top gondola rail cars capable of carrying 91 tonnes each. In 1985 forty train sets comprising 4500 rail cars were in service. The rail cars are owned by different agencies, including the coal producers, the rail companies, private utilities and private leasing companies. Although cars are similar in design and dimensions, many variations occur, particularly in the sill height of the cars. Consequently, some trains will have cars of different heights, and this is reported to affect the operation of the loading and spraying systems.

Even though load out facilities vary from mine to mine, flood-loading chutes are used almost exclusively to fill the cars as the train moves continuosly through the loading loop. Chutes are operated either manually or automatically. Loading a standard train set takes up to four hours. The larger mines in western Canada load an average of two trains per day.

* These annotated references refer to the appropriate sections in the background report *"Report on the Emission and Control of Fugitive Coal Dust From Coal Trains."*

All of the export terminals on the Pacific Coast at Delta, Vancouver and Prince Rupert employ rotary dumpers to unload trains. The two largest terminals, at Delta and Prince Rupert have continuous rail loops, fully automatic car indexing and tandem dumping facilities. The unloading operation is generally accomplished in 2-4 hours. Under ideal conditions the turnaround or cycle time for a train travelling from the coal fields to and from the terminals (approximately 2200 km) is 72 hours.

2.3 Coal dust emissions

(Reference Section 3.3)

The quanitity of wind-entrained dust from coal cars is the result of many factors. To date, there is no practical method for measuring, directly, the amount of coal dust lost in transit. Although weighing loaded cars before and after a journey has been tried it has proved difficult and inconclusive. Consequently, no firm data on fugitive dust losses are available.

Estimates of coal dust losses range up to 3% of the total coal load for trains travelling a distance of 1000 kms. when no dust control measures are employed. Some estimates of theoretical coal dust losses are presented in Table 1 to illustrate the range of potential controlled and uncontrolled emissions. For the controlled case, it has been assumed that chemical dust suppressants provide a surface crust retention of 85% when the trains arrive at the terminal and that the amount of crust cover retained reflects a proportional degree of emission control.

Dust emissions from empty trains arise from residual coal deposited on external surfaces of the rail car and/or from coal retained inside the car. During cold weather periods, frozen coal retained inside the cars can also be a source of emissions.

2.4 Effects of coal dust emissions

(Reference Sections 3.4, 3.6)

Historically, public concerns have been expressed over the deposition of coal dust near the rail lines as a result of fugitive emissions from loaded and empty trains. The dust causes soiling of personal property, house exteriors and sometimes the interiors of residences and businesses. The aesthetic impact of coal dust from passing trains is classified as a problem of nuisance pollution.

Coal dust levels in ambient air, arising from rail transportation, are not considered to be a hazard to human health. With respect to air quality standards, there are no federal or provincial standards which apply specifically to coal material. Existing air quality objectives for particulate matter apply to total suspended particulates and total dustfall but not to coal particulates.

Table 1

Estimated coal losses for shipments to British Columbia terminals

Uncontrolled emissions

Uncontrolled emission factor (% of load)	Coal loss/train (tonnes)	Potential loss from 24.8 MM tonnes (1984) (tonnes)
0.25	25	62,000
0.50	50	124,000
1.00	100	248,000

Controlled emissions

Uncontrolled emission factor (% of load)	Coal loss train with 85% crust retention (tonnes)	Potential loss from 24.8 MM tonnes (1984) (tonnes)
0.25	3.7	9,300
0.50	7.5	18,600
1.00	15.0	37,200

**The coal producers in western Canada do not accept these calculations as representing actual coal losses.*

2.5 Factors affecting crust retention

(Reference: Sections 4.1, 4.2, 4.3, 4.4)

Studies have shown that many factors affect the crust integrity of chemical dust suppressants. While some are related to the basic properties of the chemical sealants and application techniques, others are caused by different loading and operating practices. For loaded trains, some of the relevant factors include:

a. **Type and application of chemical sealants:**
The basic chemical and physical characteristics of chemical sealants inherently affect their crust forming properties. The concentration and volume of solution applied and the application techniques used are also important variables;

b. **Load profiles:**
Variations in the design of mine load-out facilities and load levelling devices result in wide variations of surface profiles in loaded coal cars among the different companies. Irregular profiles, humps, ridges and slopes near the front and rear of the cars adversely affect uniform application of the chemical sealants. Surface irregularities are also more susceptible to wind erosion which causes crust failure;

c. **Coal car design:**
Some coal train systems operate with cars of different ownership and design. The variations in car capacity and particularly the heights of the cars within a train set makes it difficult for loading operators and spray equipment operators to produce proper loading profiles and to apply adequate amounts of chemical sealants;

d. **Weather Conditions:**
High wind conditions may adversely affect the application of chemical sealants where spray headers are not adequately shielded and extreme cold weather may cause freezing problems in unprotected pipes.

AIR QUALITY MONITORING AND CRUST ASSESSMENT

3.0

The lack of suitable air sampling methods and appropriate analytical techniques for identifying the coal fraction in a particulate matter sample precludes a rigorous evaluation of dust control performance. However, subjective judgement is a useful means by which to assess the effectiveness of the dust abatement measures.

At present, fugitive dust emissions from trains are assessed by observing visible dust from individual trains or by measuring relative ambient aerosol concentrations, while dust control performance is determined by monitoring crust retention on loaded cars arriving at the terminal.

3.1 Visual observations

(Reference: Section 3.9)

Visual observations of coal trains have been useful in assessing the severity of dust from trains at various locations along rail corridors. In a qualitative way, visible dust emissions also reflect the effectiveness of dust control measures. Some disadvantages of this method are:

a. observations are practically impossible at night time;

b. the method lacks a calibration procedure since conventional stack opacity procedures are not applicable;

c. the method is subjective and can vary between observers and between different observations by the same observer;

Based on studies by Environment Canada at Agassiz, B.C. a classification system has been developed to categorize visual emissions into four categories, namely: "heavy," "medium," "light," and "not dusting." Plates 1 and 2 illustrate the visibility of emissions from a "heavy" and "light" dusting train respectively.

This approach has enabled the implementation of a real time reporting procedure from the field whereby the coal producers and terminals are notified whenever a dusting train is observed. In turn, the companies are able to trace equipment malfunctions that caused the dusting train.

Observations of visible dust clouds have also been useful to train crews who are requested to reduce train speed through the Town of Agassiz when a train is dusting.

Visual observations as a monitoring technique have been useful in communities where coal dust impacts are of concern and provide a means of resolving conflicting opinions when assessing control performance. This assessment technique can be applied to both loaded and empty trains.

PLATE 1
"Heavy" dust emissions from a loaded train travelling at 80 km/h with no dust suppressant supplied.

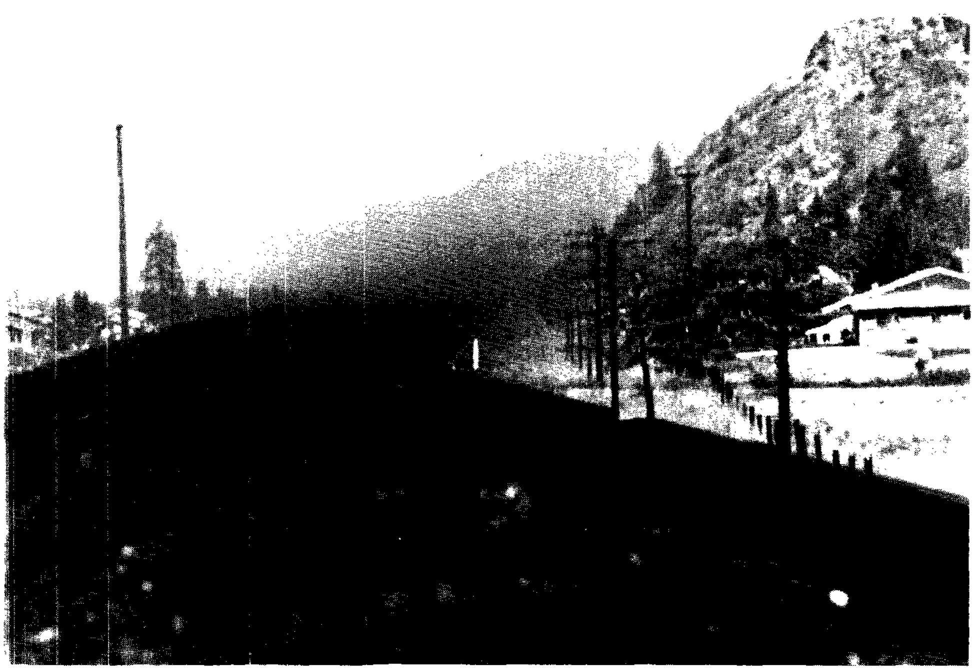

PLATE 2
"Light" dust emissions from a loaded train travelling at 80 km/h with dust suppressant applied.

3.2 Air quality monitoring instrumentation

(Reference: Section 3.7)

A number of different air quality sampling methods have been tested and evaluated to measure ambient particulate levels associated with coal dust emissions from trains.

A summary of the sampling instrumentation and analytical methods is shown in Table 2. The standard instruments which measure particulate matter concentrations are effective and enable a general assessment of air quality. Difficulty arises in relating results from such measurements to public perception and nuisance soiling caused specifically by coal dust.

3.3 Analytical methods

(Reference: Section 3.7)

Filter samples obtained from conventional samplers, namely the high-volume sampler and dustfall sampler, require further analysis to determine the coal fraction in the total particulate matrix. Preliminary studies have focussed on the analysis of the coal fraction on filters from the two samplers.

One method utilizes computer scanning electronic microscopy to identify and count carbon particles on the filter substrate, thus providing the basis for calculating the coal fraction. Another method utilizes the so-called chemical mass balance approach by analyzing a spectrogram of trace metals and organics. Although these methods show some promise more research is required before they can be reliably and routinely implemented.

An optical microscopy method has been developed by the British Columbia Ministry of Environment especially for coal analyses. This method has severe limitations for field applications because it requires a monolayer of particles on a membrane filter.

3.4 Crust retention measurements

(Reference: Section 3.8)

The first technique developed for assessing the performance of dust suppressants employed measurements of crust retention based on the assumption that chemical sealant solutions sprayed on the loaded cars at the mines form a stable crust after curing. Observed crusts are typically 2 centimetres thick, sometimes reaching a thickness of 15 centimetres.

The crust areas that are still intact on arrival at the terminal can be distinguished from areas where crust failure has occurred. A method for measuring crust retention was developed and is described in Section 6. The technique has been accepted by the industry and is presently used in evaluating the performance of existing and new chemical sealants.

MONITOR TYPE	OPERATING MODE
Modified High Volume Sampler	sampler runs for 5-10 minutes during passing train
Standard High Volume Sampler	sampler runs for 24 hour period
Dustfall Sampler	sampler installed for 30 day period
Continuous Particulate Sampler	continuous with real time output of particulate concentration
Soiling Index Sampler	one hour spot samples

Table 2

Summary of air quality monitoring instrumentation

ADVANTAGES	DISADVANTAGES
able to capture particulates larger than aerodynamic size limit of standard sampler able to identify specific dusting trains reasonable correlation with opacity of visual dust emissions	data cannot be related to standard air quality objectives manpower intensive coal dust fraction is difficult to analyze
data can be related to standard air quality objectives provides indication of total suspended particulate levels unattended operation except for servicing	cannot be used for episode monitoring to identify specific dusting trains coal dust fraction on filter is difficult to analyze
data can be related to standard air quality objectives provides indication of total suspended particulate levels unattended operation except for servicing	cannot be used for episode monitoring to identify specific dusting trains coal dust fraction is difficult to analyze
limited results show potential for correlating data to the opacity of visual dust emissions real time output enables identification of specific dusting trains unattended operation except for servicing	unattended operation cannot be used to instantaneously identify coal dusting trains instrument should be calibrated for each type of coal dust limited to fine particles — no samples collected for analysis
results can be related to air quality objectives unattended operation except for servicing	unable to capture large coal dust particles not sufficiently sensitive to correlate with opacity unable to identify in real time specific dusting trains

4.0 COAL DUST CONTROL MEASURES

4.1 Surface profile

(Reference: Section 5.2)

The experience gained over the past few years, together with the studies that have been carried out by industry, have shown that surface profiles are the single most important factor in ensuring crust integrity. A uniform flat surface profile across the full length and width of a loaded car will result in the most stable crust. A flat surface profile is desirable for the following reasons:

1. The chemical application and solution penetration are uniform, in contrast to irregular profiles with humps, ridges or steep end slopes, where the solution tends to run off the slopes and pond in low spots;

2. The crust formed over a flat surface profile is structurally more stable than the crust resting on irregular profiles. The resulting "mat" is less subject to failure from load settling and car vibrations;

3. A flat surface profile minimizes air turbulence over the surface in contrast to irregular profiles that show preferential crust erosion from air turbulence;

4. The exposed surface area is minimized.

4.2 Chemical sealants

(Reference: Section 4.1)

Extensive research has been carried out on the various types of sealants being marketed as coal dust suppressants. Diverse formulations are available, including oils, waste oils, oil emulsions, latex sealants, lignin derivatives, polyacrylamides and proprietary formations.

Oil and asphalt emulsions show good wetting for coal and form a pliable crust with good regenerative properties. However, these compounds may adversely affect rubber conveyor belts. Some latex-based chemical sealants form highly brittle crusts which are easily damaged and display little or no regenerative properties. Emulsions may require pretreatment or wetting of the coal surface with a surfactant to increase penetration. Water soluble lignin derivatives are subject to leaching during rainfall.

It should be noted that some of the chemicals are environmentally toxic and present potential problems if spray run-off and spillage is allowed to fall onto ground unprotected by a collection pad.

In general, the following properties are deemed desirable for dust suppressants:

- good affinity for coal
- ability to form a viscous crust with good regenerative properties over a range of ambient temperature conditions:
- direct application to coal surface without requiring a prewetting agent:
- formation of a crust which is resistant to leaching and other weather-related damage:
- formation of a well-mixed, stable solution which can be applied without clogging piping or nozzles;
- formation of a crust which adheres well to the substrate, particularly on slopes and irregular surfaces;
- formation of a crust which is resistant to shock and vibration damage;
- minimal fouling of rail cars, conveyor belts or other equipment;
- short curing time;
- non-toxic to human health during handling;
- non-toxic from an environmental point of view;
- cost effective.

The concentration and volume of the applied solution required to achieve effective dust control varies amongst products and continues to be an important subject of research between mining companies and chemical suppliers.

4.3 Spraying systems

(Reference: Section 4.1)

A variety of designs of spraying facilities are presently in use at different mines. Features vary in terms of the number of spray headers, the height of spray headers above the car and the number of nozzles on the header. Some mines, for example, use only a single spray header, while others employ a number of consecutive spray headers. At one location, multiple headers are used to spray cars alternately with chemical sealant and water as the cars move through the spray installations. The intent of water soaking is to improve penetration of the sealant into the top surface layer of coal. However, laboratory tests with some water-latex emulsions have shown that water soaking increases the depth of solution penetration at the expense of crust strength. Curing time also increases with dilution and the resulting crust, although thicker, is less cohesive.

Even though there are freeze protection methods for piping, spray headers and nozzles, under extreme weather conditions problems may be encountered with frozen and plugged systems.

Spraying patterns at some locations are not designed to ensure that the solution reaches the sidewalls and endwalls of the cars. In some cases improper nozzle selection or lack of system pressure may be a contributing factor.

Wind distortion of the spray pattern may result in improperly sprayed cars. Poor spraying is attributed in part to insufficient system pressure or headers positioned too high above the cars.These problems can be minimized with proper design, although at some locations wind screens may be required.

In addition to the shortcomings listed above, mechanical or other failures can cause some cars within a train or an entire train to leave a load out without it being sprayed.

Plate 3 shows a spray facility with a single spray header in operation, preceded by a load levelling and compacting device designed to achieve a flat profile.

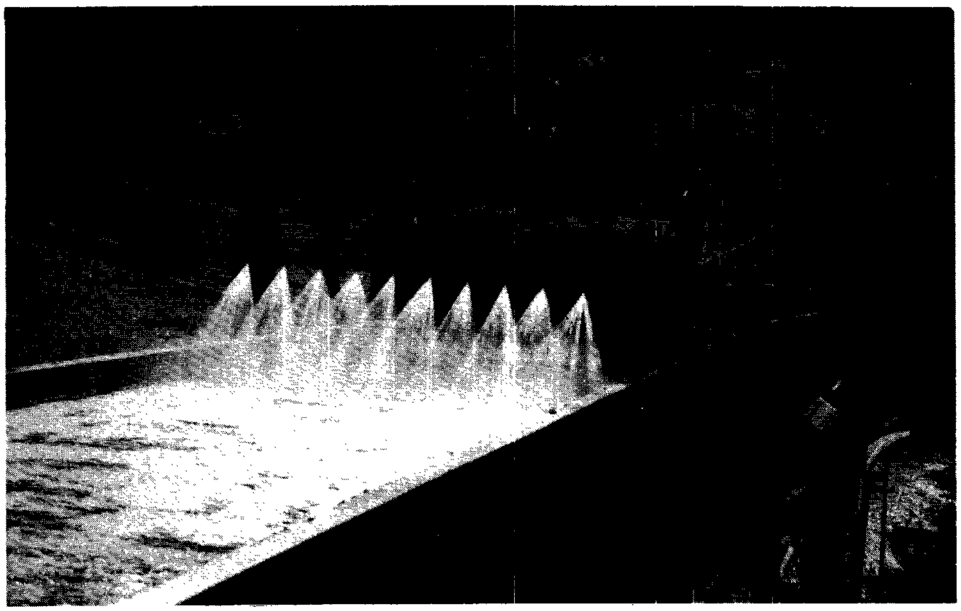

PLATE 3
Spray facility with single spray header preceded by a load levelling and compacting device.

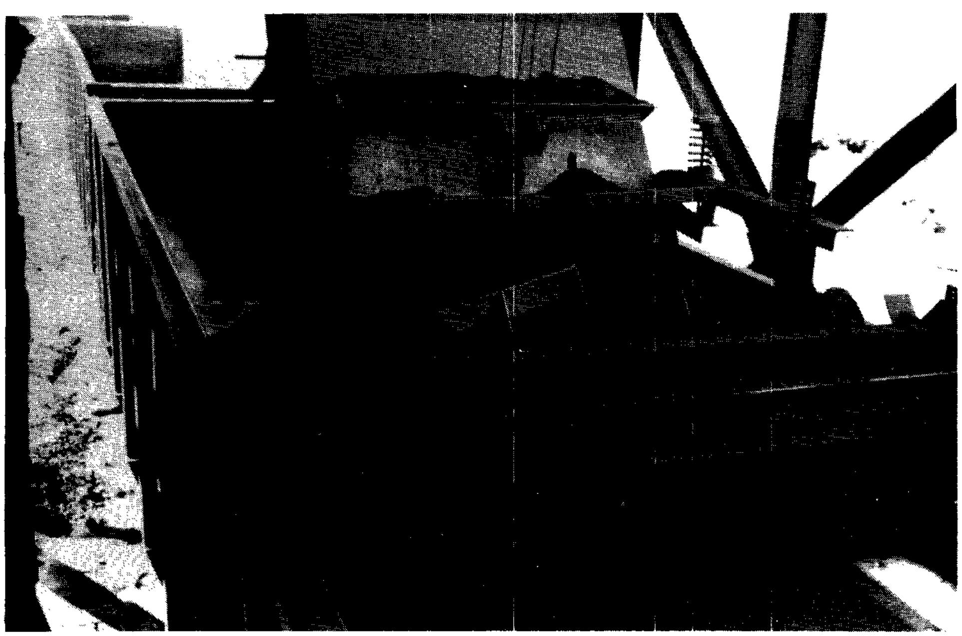

PLATE 4
Flood loading chute with load levelling apparatus.

5.0 OPERATIONAL FACTORS

5.1 Load leveling

(Reference: Section 4.3)

As discussed in Section 4.1, flattening the surface profile on loaded coal cars is a crucial preparatory step in a dust control system that employs chemical dust suppressants. Various levelling systems have been developed at different mines. Cars are usually loaded with full card width flood-loading chutes. At some load-outs heavy rubber flaps are attached to the trailing edge of the loading chute or to the shed outlet doors so that the flaps drag along the coal surface, giving it a flatter profile. Other load-levelling systems emply levelling bars, plow-type levellers and rollers. The weight of some of these devices also compacts the surface, thus enhancing crust stability. Plate 4 shows a train being loaded with a flood-loading chute equipped with a flexible rubber sill sweeping device.

There are two major factors which influence the surface profile: the time involved in releasing the coal charge in the chute and the time required to shut off the charge and, in some cases, lift the chute above the rear sills of the coal cars. This timing is important as it will determine the angle and depth of the slopes left at the front and rear of the car. With a manually operated loading chute the skill of the loading operator is critical in this regard. Timing problems may be minimized by the use of automatic controls or by training of the loading operator.

An additional factor which determines the type of loading profile is the random occurrence of coal cars of different sill height within the train set. This requires the loading operator (or automated loading system) to adjust the position of the loading chute and the load-levelling device for each successive car of different height. The delays and errors accompanying these adjustments frequently cause distorted profiles and long end slopes. Studies have shown that cars from mines which load cars of uniform height have consistently flatter loads than cars from mines where car heights vary.

Coal remaining on the car sills after loading is another source of fugitive dust.

5.2 Load compacting

Compaction of the coal surface markedly enhances the crust retention on levelled coal cars. This effect is clearly shown in Plate 5 where a compaction device was activated to compact the load over the back half of the car while the front half of the load was not compacted. The sealant application rate was uniform over the entire length of the car.

5.3 Overloading

(Reference: Section 4.6)

The present maximum weight rating of the rail track is 119275 kilograms. Occasionally loaded cars exceed this limit and the accepted practice in such instances has been to remove some of the cargo with front end loaders or similar equipment.

5.4 Load settling

(Reference: Section 4.1)

While a train is in motion, the coal is subjected to continuous low level vibration, as well as high intensity shocks during starting and stopping. This causes the load to compact and settle. In a fully loaded car, the load can settle up to 30 cm after travelling 1100 kms. The majority of the settling occurs in the first 150 kms. This phenomenon affects the surface crust to varying degrees, depending on the extent of settling. the integrity of the surface crust and the extent of end and side surface slopes. End and side slopes which may have inherently weaker surface crusts due to varying degrees of run-off during spraying are particularly prone to deterioration as the load settles. Although load settling cannot be prevented a flat surface profile and a resilient surface crust will maximize crust retention.

5.5 Empty cars

(Reference: Section 4.7)

Cars unloaded in rotary dumpers at the exporting terminals may retain significant quantitites of coal on exterior horizontal surfaces, such as the upper and lower sills and front and rear platforms, as well as on the inside of the car. Properly designed air or water car-cleaning systems will remove the external coal deposits.

During cold weather periods, substantial quantities of frozen coal may remain in cars at the Vancouver terminals where thaw sheds are not used.

Frozen coal carry-back generally varies from 0 to 6.3 tonnes per car, and in extreme cases may be as high as 25 tonnes, or 25% of car capacity. Apart from economic considerations associated with reduced load capacity, frozen coal can be a source of dust emissions. Industry is encouraged to continue its investigations into methods for reducing the problem of frozen coal.

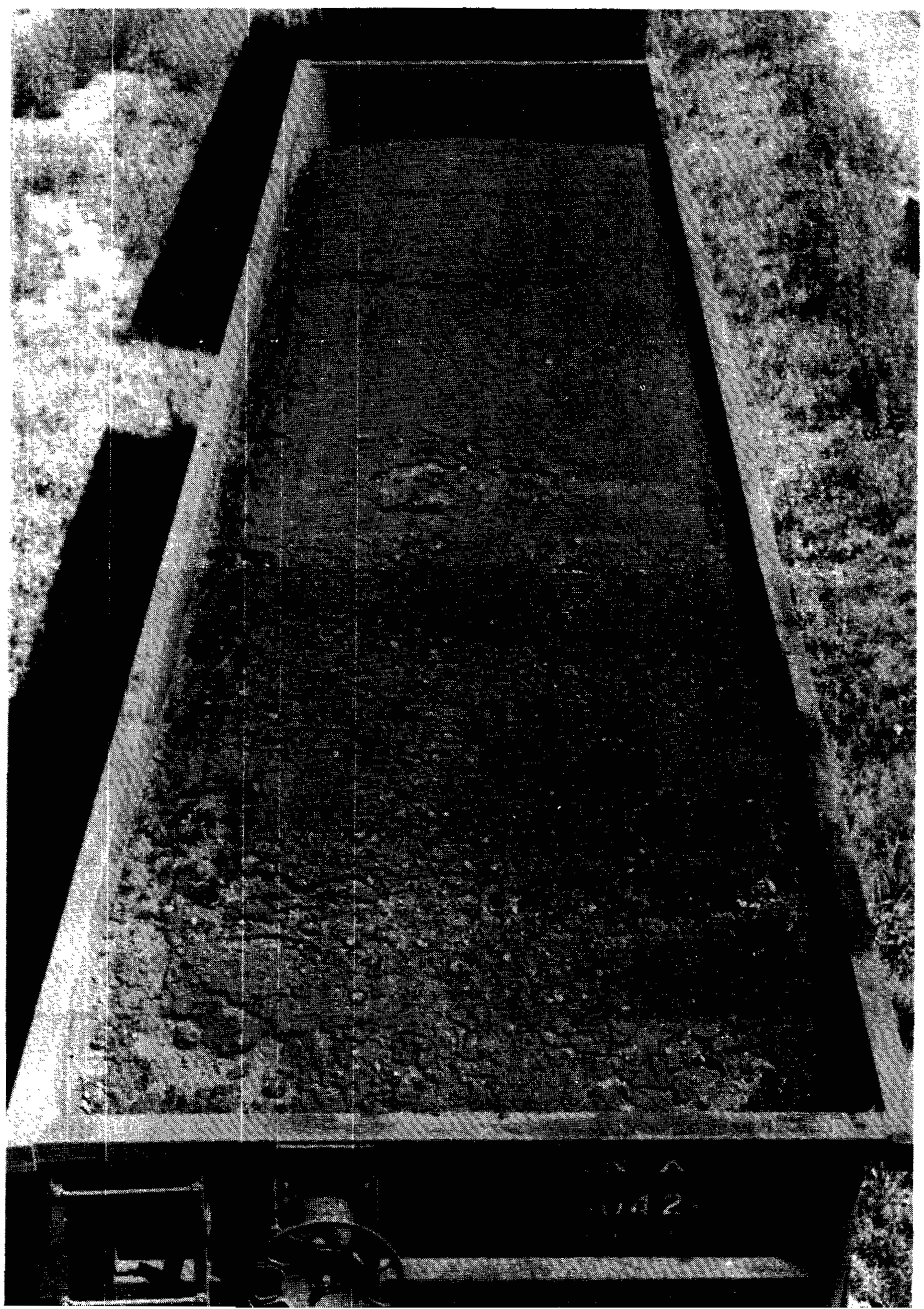

PLATE 5
Illustration of enhanced crust retention on the rear half of a coal car attributed to compaction.

RECOMMENDED CRUST RETENTION OBJECTIVE 6.0

(Reference: Sections 3.8.2 and 7.2)

The effectiveness of dust control measures can be assessed using the concept of crust retention. It is based on visual observations of exposed surface areas not covered by the crust when a train arrives at a terminal.

A minimum acceptable level of dust control is generally achieved under all conditions if the crust retention of a train is at least 85%. The minimum objective for crust retention is therefore 85% and should be calculated as a "train average." The 85% retention average is a simple average, based on the average crust retention on 30 cars within a train set including, if possible, the first 10 cars, 10 cars in the mid-section, and the last 10 cars.

Although a flat surface profile is optimum, end slopes may be encountered. Therefore, each "car average" should be calculated by taking into account the exposed surface on the front slope, rear slope and the center flat section of the load. The suggested formula for this profile, as shown in Figure 1, is calculated as follows:

$$\%CR = 100 - \frac{[(Lf/\cos a)(\%EF) + (L-Lf-Lr)(\%EC) + (Lr/\cos b)(\%ER)]}{[(Lf/\cos a) + (L-Lf-Lr) + (Lr/\cos b)]}$$

where:
- CR = crust area retained on the surface of a coal car
- EF = exposed area on the front slope (%)
- EC = exposed area on the center section (%)
- ER = exposed area on the rear slope (%)
- Lf = horizontal length of front slope
- Lr = horizontal length of rear slope
- L = total car length

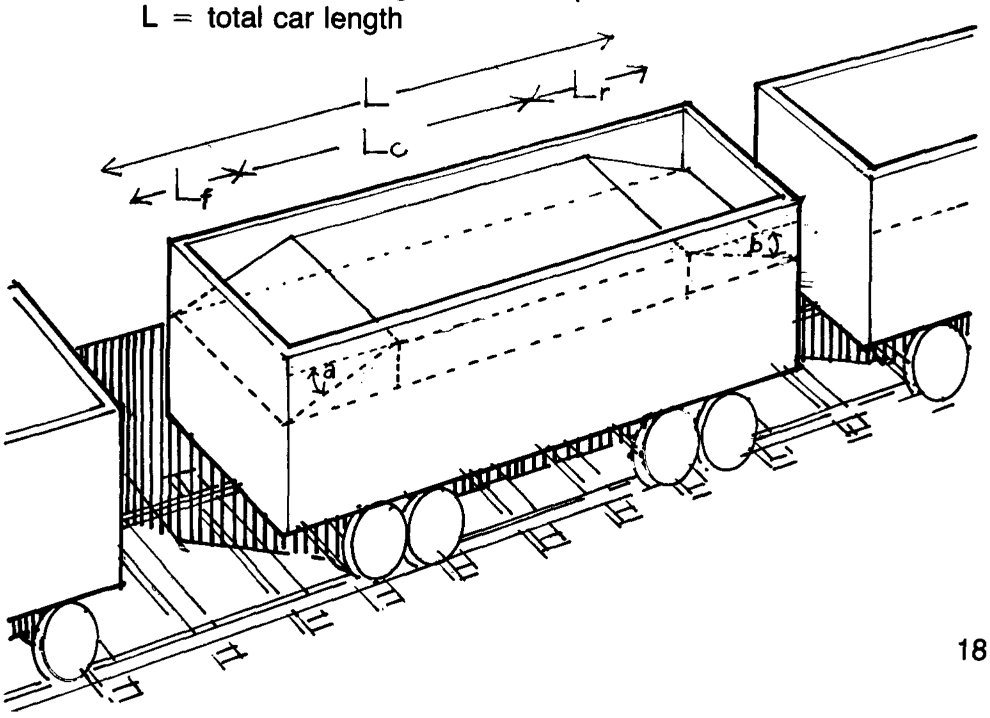

FIGURE 1
Typical load profile for determining crust retention.

Plates 6, 7 and 8 illustrate crust retentions of 90%, 80% and 60% respectively on different trains arriving at a Vancouver terminal.

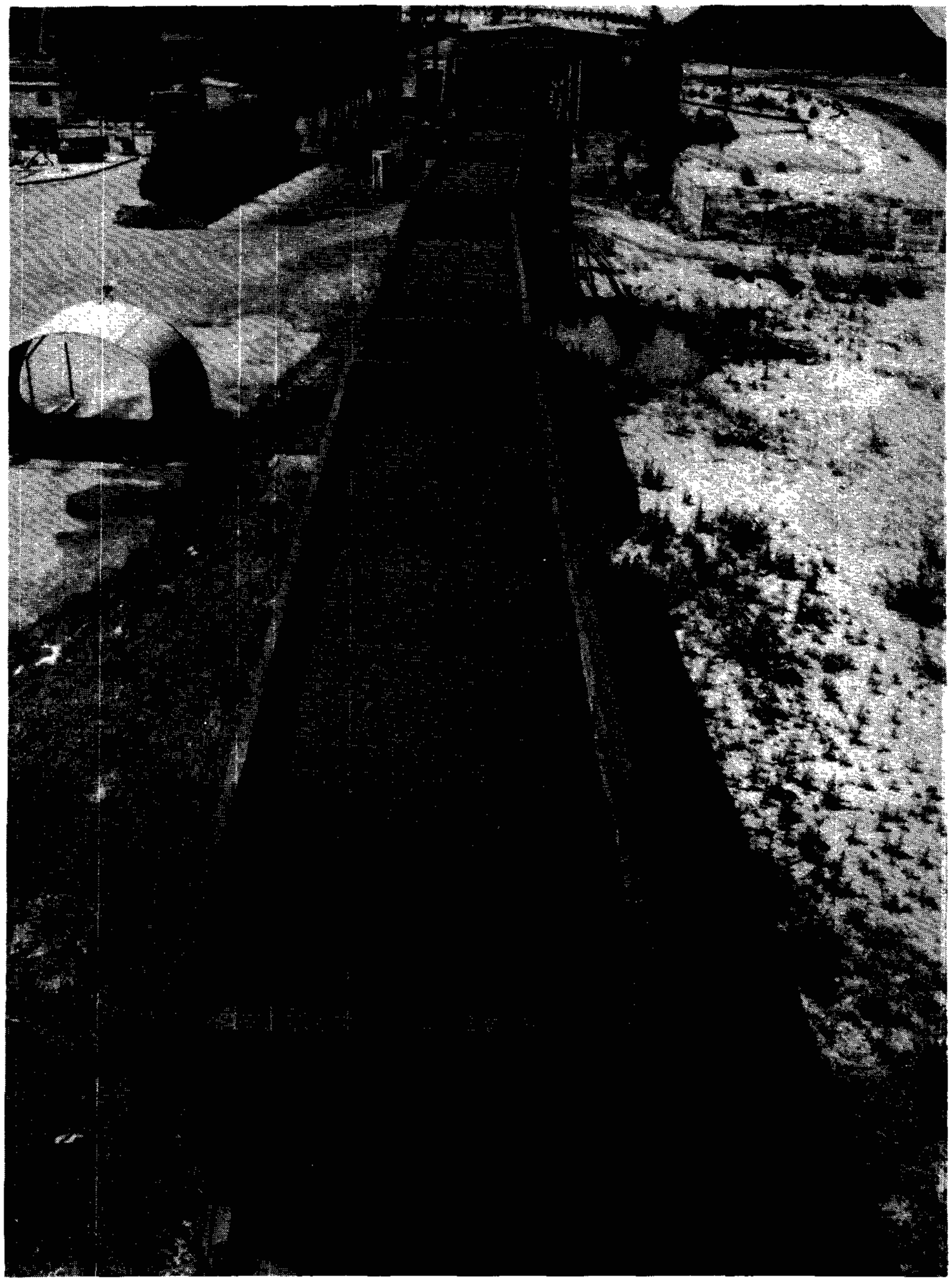

PLATE 6
90% crust retention on a coal car after travelling 1000 km.

PLATE 7
80% crust retention on a coal car after travelling 1000 km.

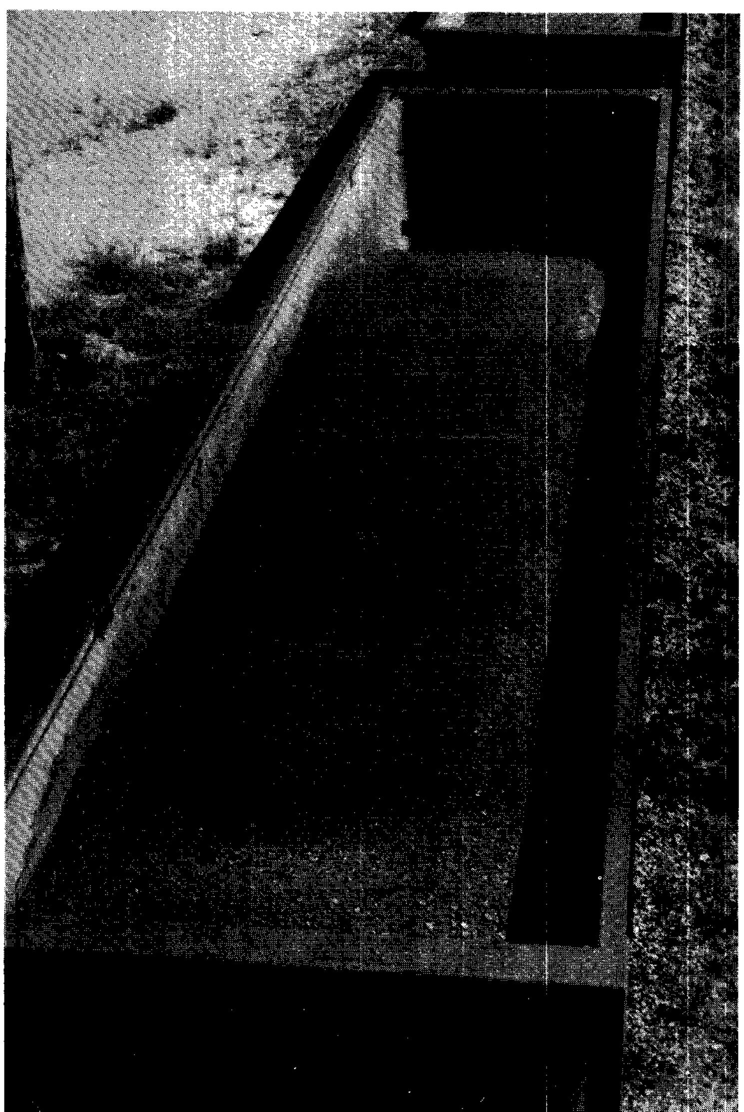

PLATE 8
60% crust retention on a coal car after travelling 1000 km.

7.0 RECOMMENDED DESIGN FEATURES

Consistent performance of the coal dust control measures can be achieved through implementation of the design features and operating practices recommended in this section. In the event of exceptional coal dust problems at any location along a coal transportation corridor, control measures beyond those presented in this section may be required. These special requirements can only be assessed on the basis of particular circumstances prevailing at those locations.

7.1 Design recommendations for load out facilities

(Reference: Section 7.1)

The optimum design criteria for loading, levelling and spraying systems are presented below. Some of these criteria may not apply where it is demonstrated that satisfactory control is being achieved. In general, each load out facility should be designed to:

a. achieve a uniform flat surface profile along the full length and width of all loaded rail cars, using either properly designed loading chutes or separate levelling devices;

b. provide a device to remove loose coal from the rail car sills using either sill sweeping devices incorporated as part of the load out station or a separate mechanism located before the chemical spraying station;

c. provide a chemical application spraying system consisting of primary and secondary spray units, each equipped with its own pumping unit, discharge piping, flow meter and spray header. The secondary spray unit should be located a sufficient distance from the primary unit to allow the identification of problem cars and to facilitate re-spraying. At facilities where only one spray header is used, trains should be backed up and re-sprayed if improperly sprayed the first time;

d. employ spray patterns that achieve complete and uniform coverage over all areas of the load surface within a car, regardless of the train speed through the load out;

e. provide freeze protection for effective operation during cold weather periods;

f. use spray nozzles compatible with the chemical requirements of the chemical solution and applied pressure;

g. provide wind screens to prevent spray pattern distortion at sites where high winds prevail;

h. provide a compressed air supply to clear blocked nozzles;

i. provide adequate mixing in the tanks where batch solutions are mixed;

j. provide a sufficient volume of mixed solution to spray a complete train when batch mixing systems are used;

k. provide automatic low level sensor and audible alarm on the solution storage tank for batch mixing systems or on the chemical storage tank for in-line mixing systems:

l. provide a flow metering device on the piping to the spray header to record flow rates and total volumes applied to each train;

m. provide variable flow to the spray header in order to apply more solution volume to the end slopes in relation to the center flat section of the load profile.

7.2
Design recommendations for empty rail car cleaning facilities

(Reference: Section 7.5)

Where there is a continual coal dust problem from empty trains, each terminal should provide an exterior rail car cleaning facility designed to remove loose coal deposited on the external car surfaces.

Water washing systems should have:

a. adequate system pressure and spray pattern to reach all exterior surfaces of the car:

b. a self-draining system for the piping and spray headers to prevent freezing in cold weather operation.

c. a wash water collection pad at the spray station to collect the wash water for recycling;

d. a waste water treatment facility to meet local requirements for suspended solid removal before discharging to the receiving environment.

Air cleaning systems should provide:

a. adequate system pressure and air jet pattern capable of reaching all exterior surfaces of the car;

b. an enclosure for the rail car cleaning system. The enclosure should be equipped with an adequate air exhaust system;

c. a high efficiency emission control system on the air exhaust from the cleaning station capable of meeting the air pollution control requirements of local regulatory authorities.

7.3 Recommended operating practices

7.3.1 Load out facilities

(Reference: Section 7.1)

As a general requirement, the coal producers should plan and implement training programs for company employees assigned to the loading, levelling and spraying operations and emphasize the importance of proper system operations for achieving coal dust control. Training in environmental control could be integrated with other employee training programs such as technical and safety programs.

Proper maintenance of load levelling equipment, sill cleaning devices and spraying equipment is essential. A comprehensive schedule of preventive maintenance of these systems should be implemented and an adequate supply of chemicals, spray nozzles and other essentials should be kept in stock. Each mine should develop a set of procedures to be followed in the event of equipment malfunction during the load out operation in order to avoid the possibility of poorly sprayed cars leaving the mine.

Operating procedures should include the following main features:

a. verify the proper operation of all equipment when loading the first cars, in particular the operations of the load leveller/compactor, sill sweeper and chemical spray system;

b. when load adjustments are made at the mine, the load should be levelled and re-sprayed with sealant prior to departure from the mine site;

c. verify the concentration and volume of the chemical solution before spraying a train for batch mix systems, and pump flow rates and settings for in-line mixing systems;

d. ensure that an appropriate volume of mixed solution is applied to each car;

e. inspect and adjust, if required, the operation of the system during the spraying of the first few cars;

f. re-spray any improperly sprayed cars;

g. maintain records of solution concentration and volume for each train, including notes on system malfunctions, profile problems or other deficiencies.

While research and devėlopment are encouraged, proposed changes in chemical sealants should be first reviewed by the senior operating employees responsible for dust control operations and then approved for testing and/or routine use.

7.3.2 Empty car cleaning facility: coal terminal

(Reference: Section 7.6)

Personnel involved with the operation and maintenance of the car cleaning system ,should be formally trained and advised on environmental requirements.

Equipment malfunctions should be corrected immediately. Standby truck mounted spray systems, normally used at terminals to control fugitive coal pile emissions, should be used to used to wash rail cars in case of malfunctions in the car cleaning system.

Trains should be visually inspected and cleared by a designated employee prior to departing the terminal.

7.3.3 Coal train operations

(Reference: Section 7.5)

Railway companies should provide coal train sets consisting of cars of uniform height when practical. Where cars of different height must be used within a train set, cars of similar height should be grouped together.

Locomotive speed control systems at load out facilities should be maintained operational to ensure proper loading of coal.

In the event of heavy dust emissions from loaded or empty trains, train crews should be instructed to reduce the train speed to prevent dust emissions through communities where coal dust impacts are of concern.

RECOMMENDED MONITORING 8.0

The monitoring requirements are a general provision to accommodate situations where and when environmental problems may arise along a transportation corridor and are not intended to impose monitoring by industry when no problem exists.

8.1 Performance monitoring

(Reference: Section 7.3)

Crust retention monitoring should be carried out using the methodology outlined in Section 6 or an equivalent method. It is suggested that each mining company arrange with its associated terminal operator to monitor one out of twenty of its trains arriving at the terminal. Records of data should be maintained and submitted as required to the appropriate government authorities.

In some cases the reliability of the control measures may be sufficiently high as to not require any crust retention monitoring, while in other cases more frequent monitoring may be needed. Alternatively, monitoring frequencies may require adjustment during seasons when dust emissions are a problem.

The coal producers, together with the associated terminal operators, should co-ordinate the performance monitoring program.

8.2 Environmental monitoring

(Reference: Section 7.3)

Along rail corridors where coal dust emissions are an environmental problem, the coal producers should consider monitoring visible dust emissions from trains, air quality and crust retention as appropriate. While loaded trains are the sole responsibility of the coal producers, both the coal producers and the terminal operators share the responsibility for empty coal trains.

A communication procedure should be implemented to report dusting trains on a real time basis back to the respective coal producers or terminal operators whenever a rail corridor monitoring program is established.

The data from all monitoring programs should be submitted to the appropriate government agencies as required.

REFERENCE

Report on the Emission and Control of Fugitive Coal Dust from Coal Trains. *Environmental Protection Service, Environment Canada,* April, 1986.