

THE INTEGRATION OF MINE OPERATIONS AND MINE MAINTENANCE GROUPS WITHIN TECK COAL

by

Matthew L. Cole P.Eng.
Bachelor of Applied Science 1985

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Approval

Name: **Matthew L. Cole**

Degree: **Master of Business Administration**

Title of Project: **The integration of mine operations and mine maintenance groups within Teck Coal**

Supervisory Committee:

Dr. Ian P. McCarthy
First Reader

Professor & Canada Research Chair in Technology &
Operations Management
Faculty of Business Administration

Dr. Mark Selman
Second Reader

Special Advisor to the Dean
Faculty of Business Administration

Date Approved: _____

Abstract

Open pit coal mining is an equipment intensive process. The availability and the cost of operating the equipment is one of the most significant aspects of the operation. Focusing on Teck Coal, a subsidiary of Teck Resources Ltd., in this paper I examine how the current structure and relationship between the mine operations and maintenance groups impacts the effectiveness of the organization. I will discuss the benefits and the need for collaboration between the two groups, and examine the current adversarial relationship that exists. Through interviews with several key people within the organization I will determine where the adversarial relationships may have come from, make recommendations to bring the two groups closer together and ultimately describe a processes of implementation in order to achieve the desired cultural change.

Dedication

I would like to dedicate this paper to my wife Joanne and children, Dillon and Adrian. Without their constant support and understanding over the past 5 years I would not have been able complete this program.

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I would like to take the opportunity to thank my supervisor Larry Davey, who helped me formulate the topic for this thesis. I would also like to thank Don Sander, Dan L'Heureux, Ed Morash, Kelly Parker and Peter Neben who agreed to participate in the interviews conducted during their already very busy schedules. It was through discussions with these individuals that the basis of my work began to solidify.

Table of Contents

Approval	i
Abstract	ii
Dedication	iii
Acknowledgements	iv
Table of Contents.....	v
List of Figures	vii
Glossary	viii
1.0 Introduction	1
1.1 Company Overview	2
2.0 Analysis of Current Operations	5
2.1 Functionality of mine operations and mine maintenance	7
2.1.1 Mine operations	7
2.1.2 Maintenance	9
2.2 Why the need for a collaborative relationship	10
2.3 Evidence that there is a non collaborative relationship	12
2.3.1 Mine operations	13
2.3.2 Maintenance	13
2.4 What are the sources of the combative relationship that currently exists?	13
2.4.1 Mine operations	14
2.4.2 Maintenance	15
3.0 Recommendations.....	18
3.1 Senior management commitment	18
3.2 Increased resources in planning and scheduling	18
3.3 Provide mentoring of maintenance foremen	19
3.4 Create a lower level connection between the two groups	20
3.5 Cross functional Meetings.....	21
3.5.1 Daily meetings.....	22
3.5.2 Weekly meetings	22
3.5.3 Pre P.M. and post P.M discussions.....	23
3.5.4 Focus group meetings.....	23
3.5.5 Quarterly meetings	23
3.5.6 Open discussions on incident investigations.....	24
3.6 Cross functional training	24
3.7 Reward systems	25

4.0 Implementation.....	27
4.1 Step 1: Creating a sense of urgency.....	27
4.2 Step 2: Creating a powerful guiding coalition	28
4.3 Step 3: Clearly identify the vision	29
4.4 Step 4: Adequately communicate the vision	29
4.5 Step 5: Remove obstacles to the vision.....	30
4.6 Step 6: Create a plan for short term wins.....	31
4.7 Step 7: Use short term wins to gain momentum for additional and deeper change.....	31
4.8 Step 8: Anchor change to corporate culture	32
5.0 Conclusion.....	33
Appendix.....	35
Bibliography	46

List of Figures

Figure 1 Map of properties within Teck Coal.....	3
Figure 2 Graph of Teck Coal Market Share of the sea borne hard coking coal market.....	3
Figure 3 Graph of historical pricing of hard coking coal.....	4
Figure 4 Flow chart of current site structure.....	7

Glossary

BCM – Bank cubic meter. Refers to the volumetric measure of material in the mining process before it is blasted. Once material is blasted it swells (gains volume) by 15-30% due to the introduction of voids. The measurement can be applied to waste rock (BCM_W), raw coal (delivered to the plant) BCM_{RC}. Or the combination of the two referred to as total material BCM_{TM}.

Celerant – A global management consultancy specializing in operational improvement with headquarters in the United Kingdom and operations in over a dozen countries.

Celerant Initiative. Also referred to as the “Maintenance Performance Improvement Initiative, or M.P.I.”. The mission of this initiative is to:

- Implement and maintain best practices in the core maintenance functions to ensure the effectiveness and efficiency of work execution.
- Build a collaborative relationship between maintenance and operations that ensures joint responsibility for the condition and effective operation of equipment.
- Apply proven reliability practices such as Reliability Centered Maintenance and Root Cause Failure Analysis to improve equipment, maintenance and operating performance.
- Expand Predictive Maintenance practices to prevent failures and reduce work volumes.

Maintenance – Refers to the mine maintenance group. This group is responsible for the maintenance of all the mobile equipment utilized by the mine operations group. Although this paper may apply to the plant maintenance and plant operations group as well, they were not included in the scope of this paper. Typically the mine maintenance group makes up approximately 30% of the total employees at an operating open pit coal mine.

Mine Dispatch System – A G.P.S. based computerized data collection system installed on most production equipment at the mine site.

M.P.I. The Maintenance Performance Improvement Initiative also referred to as the Celerant initiative (see above).

Operations- Refers to the mine operations group. This group is responsible for production drilling and blasting as well as the removal of all waste rock and the delivery of raw coal to the processing plant. Typically this group makes up about 50% of the number of the total employees at an operating open pit coal mine.

P.C.I. coal – Refers to pulverized coal injection. This coal is of lower quality (and thus lower price) than metallurgical coal and is blown into the blast furnace.

P.M. – Is an acronym for preventative maintenance and describes the maintenance activity performed that is scheduled based on operating hours. During this activity any parts that are to be changed on a planned basis are replaced. In addition oil and filter changes (both hydraulic and air) and any other minor repairs identified by the operator are targeted for completion.

- Pre P.M. A process by which a mechanic or maintenance foreman meet with the equipment operator before the P.M. to review any issues with the equipment. The purpose of this is to ensure parts and manpower are available to complete all repairs while the equipment is in for its P.M.
- Post P.M. A process by which a mechanic or maintenance foreman meets with the equipment operator after the P.M. is complete to see if all repairs were completed to the satisfaction of the equipment operator.

Thermal Coal- Refers to oxidized coal strictly used for power generation. Typically this coal is not suitable for steel making.

1.0 Introduction

In this paper I examine how the performance of a coal mine can be negatively impacted if a poor relationship exists between the mine operations and mine maintenance groups. To address this problem, I present recommendations targeted at improving this critical relationship and also outline an implementation plan to change the current culture. I argue that these changes will reduce the adversarial relationship that currently exists between the two groups and bring them closer together to work in a collaborative manner.

Over 80 million dollars per year is spent on maintenance activities within Elkview operations. Capital is also a very high cost aspect of mining. An effective maintenance program is critical to the businesses success. In order to improve our maintenance programs many Teck sites are engaging in similar corporate maintenance and reliability initiatives. The goal of these initiatives is to improve the availability and even more importantly the reliability of the existing equipment resulting in improved equipment efficiencies within the operation and a reduction or at least a delay in the requirements for sustaining and new capital. The end result of these initiatives could result in a reduction in maintenance spending of between 10%-20% (16 million dollars per year at Elkview (Celerant 2009)). The effective integration of mine operations and maintenance has been identified as critical to the success of these initiatives. A key element identified in the maintenance performance improvement initiatives within Teck Coal was the need to move away from the traditional antagonistic relationship between operations and maintenance and move to a more collaborative one, where both groups speak the same language and have common goals to achieve the maintenance vision of:

“Doing the right thing – every time
we will lead our industry in having the right equipment
available, at the right time, and at the right cost.”

To improve the relationship between the mine operations and maintenance groups this paper will provide a brief overview of the company, and a description of the current structure of the mine and maintenance groups as they exist today. Following this overview, the paper will provide evidence that the two groups are currently not aligned. Through interviews with several key senior people within the organization an attempt will be made to identify how the negative relationship may have developed and what

potential steps can be taken to help resolve the differences. Following this the paper will develop recommendations, and provide an implementation plan with the goal of providing the opportunity for significant sustainable culture change within the organization.

1.1 Company overview

In this section I provide an overview of the company – Teck Coal whose operations are being analysed in this paper. I do this so as to provide the reader with a high level appreciation of the business as well as an understanding of the scale of the operations. These descriptions will highlight the importance of having a properly balanced structure and a flexible organization that is able to respond to the dynamic environment in which Teck Coal must operate.

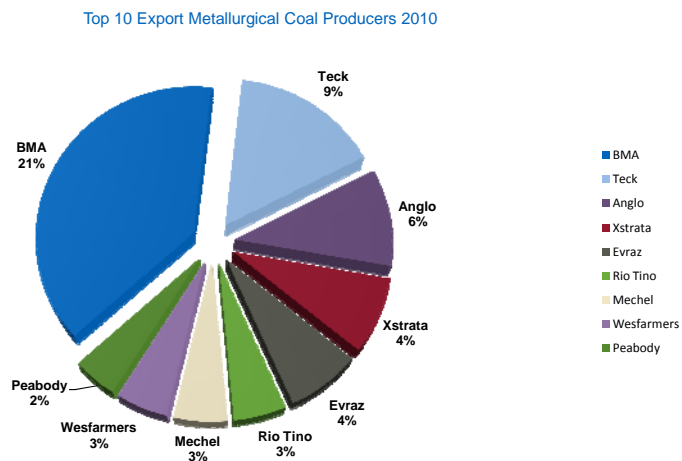
Teck Coal is a subsidiary of Teck Resources Limited and operates 6 large open pit coal mines in Western Canada and directly employs over 3,200 people. Five of these mines are located within the Elk Valley in South Eastern British Columbia and one mine is located in Central Alberta West of Edmonton. The mines predominantly produce high quality metallurgical coal for export. A relatively small proportion of the production is utilized for pulverized coal injection (P.C.I.) and thermal coal. With all six mines combined Teck Coal is the second largest producer of sea borne high quality hard coking coal in the world.

Figure 1 Map of Teck Coal Properties



Source:
<http://teck.com/Generic.aspx?PAGE=Teck+Site%2fDiversified+Mining+Pages%2fCoal&portalName=tc>

Fig 2 Teck Coal market share sea borne hard coking coal

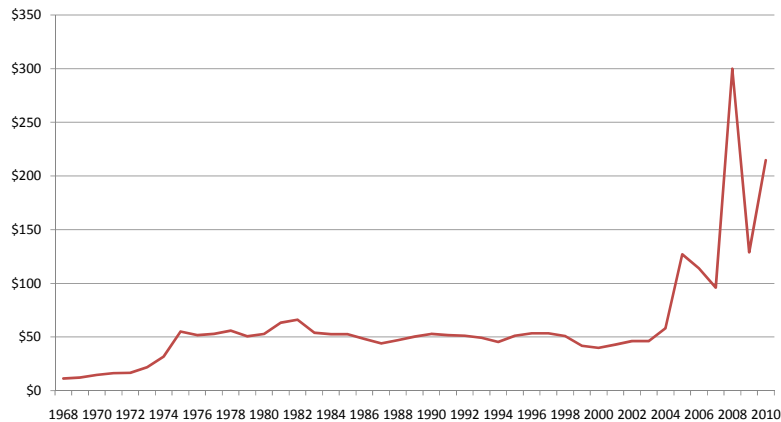


Source : AME Mineral Economics (Hong Kong) Ltd. (Data), Graph by Author

The export coal market has been notorious in recent years for being extremely cyclical. Pricing of hard coking coal was relatively stable from 1975 through 2004 however since 2004 the price has become extremely volatile resulting in swings from

US\$40 to US\$300 per tonne of clean coal. It's critical for the survival of the coal business unit that they remain competitive and efficient through these cycles.

Figure 3 Hard Coking Coal Pricing US Dollars.



Source : AME Mineral Economics (Hong Kong) Ltd. (Data), Graph by Author

In open pit coal mining the bulk of the operating costs involve mine operations and mine maintenance. When prices are high there is a requirement to maximize production, when the prices are low it's imperative that efficiencies drive the lowest cost of production available. As a result it is critical that the mine operations and mine maintenance processes be closely linked and engage in a cooperative manner to be successful at both ends of this cycle.

2.0 Analysis of current operations

In this section, I analyse the current structure and functionality within the mine operations and mine maintenance groups at Teck Coal. As will become apparent from my review, I argue that the nature of this relationship significantly affects the effectiveness of both departments at the site. Consequently, this portion of my review focuses on the organizational structure at the mine and how the relative responsibilities, incentives and control systems of the maintenance and mining departments are in conflict. Next through literature research and interviews with several key personnel at multiple operations, I will present evidence as to why a collaborative structure is necessary between the mine operations and maintenance groups. I will also provide evidence that a combative relationship currently exists and offer suggestions as to where this relationship may have come from.

It is widely recognized, that the structure of organizations can significantly impact organizational behaviours and performance (Daft 2009, Bolman & Deal 2003). The structural design of an organization affects the extent to which people are integrated or separated. This in turn impacts the extent to which collaboration and knowledge sharing might occur. Consequently, my analysis will focus on two key components that typically define how an organizational structure can vary (Daft, 2009). These are:

- The extent to which structure affects the reporting relationships and spans of control between mining and maintenance.
- The extent to which structure separates groups of employees, making it difficult for them to collaborate.

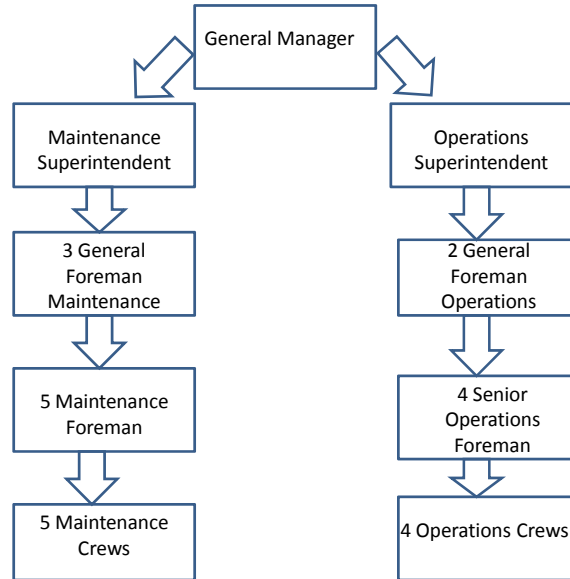
An important aspect in understanding the situation that currently exists between operations and maintenance is to understand the current structure. An organizational structure should be established that can be used as a blue print for formal expectations and exchanges between the two groups (Bolman and Deal 2003). This structure should enhance and constrain what an organization can accomplish. Care must be taken when designing this structure as it has the ability to enhance morale between two groups if it helps get work done, but will have a negative impact if it gets in the way. According to Daft (2009) an ideal structure will be vertical in nature but will also provide horizontal information flow and coordination where and when needed. The challenge comes in

deciding how much vertical and how much horizontal structure is required for the type of organization.

If an organization has strictly a vertical structure, very strong top down linkages are created, in depth knowledge and skill development are possible, and lower level goals are kept in line with top level goals. However the weakness of this structure is that it can overload the upper level hierarchy as the lower levels are not well armed to solve problems themselves and would also tend to support more of a rules based environment and would not promote innovation. Horizontal structures will promote innovation and provide rapid communication between members with different functional backgrounds which ultimately could reduce the time it takes to complete a given task. Horizontal connections also develop flexibility in terms of skill and competence by being aware of the role of others and can make members feel empowered to make decisions on their own. Overall the right level of horizontal structure will increase the level of learning due to the close contact with the other department (Anand and Daft 2007). On the other hand, if there is not enough vertical structure it can be difficult to keep goals and efforts aligned with the overall organizational goals. This is why a balance between the vertical and horizontal structures must be found.

The current overall structure at Teck Coal operations has all the maintenance and operations levels reporting directly upwards through the general foreman and superintendent level. There is little formal horizontal structure until the two lines of progression join at the general manager level. This being said, from the interviews conducted at most sites there are some levels of informal horizontal structure at levels below the general manager, the greatest of which is at the superintendent level, but the degree of cooperation and communication tends to decrease the lower down the structure you go. Until recently there have been very few meaningful joint meetings between the two groups.

Figure 4 Site structure



2.1 Current functionality of mine operations and mine maintenance.

The functions of the mine operations and mine maintenance departments are very tightly linked together. The mine cannot produce without having equipment available and the reason a maintenance department exists is to support the mine operations group. Each department contains people from quite different backgrounds and levels of education. In addition the differences in how the groups function also create quite different working environments. These differences in background and work environment result in the diverse cultural make up of each group. For this reason it's important for the reader to understand the functionality of these two groups as they currently exist.

2.1.1 Mine operations

The mine operations group is solely responsible for drilling and blasting of all the waste material, the removal of the waste material, and the recovery and delivery of raw coal to the processing plant. Nearly every person within the mine operations group work on their own and run a piece of equipment (with the exception of a small number of labourer positions). The equipment utilized within the Teck Coal operations is some of the largest in the world. Typically the mine operations group makes up approximately 50% of all personnel at an open pit coal mine and in most cases the position of haul

truck operator is considered to be the entry level position at the mine site (and thus the lowest paid). A typical progression for an equipment operator is described below:

- Haul Truck
- Dozer and or Grader Operator
- Loader operator
- Drill Operator
- Shovel Operator

Although skill development in operating a piece of equipment does take time, the basic training on most of the equipment identified above is not a lengthy process. For example a haul truck operator (after attending a one week truck school), is trained for a period of less than one month before he is “checked out” to operate on his own. Once a minimum level of seniority has been gained the individual has the ability to move up the progression identified above.

Typically the positions within the mine operations field (with the exception of the few labourer type positions) are such that an individual works on their own for the entire 12 hour shift, even their lunch breaks are taken in their equipment. There is contact with other personnel over the two way radio, but because of the size of the site these conversations are typically limited to business discussions only to minimize traffic on the radio. Although safety is always the paramount concern, individuals within this group are production oriented. The supervisor’s expectations from every individual usually involves, loads per hour, loads per shift etc.

The mine attempts to invest sufficient capital into equipment such that there is enough equipment (including spares) to achieve the goals set each year for material movement. If a piece of equipment has an unplanned break down, the operator is simply taken off and assigned another piece of equipment.

2.1.2 Mine maintenance

The role of the mine maintenance group is to ensure that the mine operations group is supplied with reliable equipment to meet its goals, as well as to help minimize the overall operating cost of that equipment. The equipment this group is responsible for includes not only the large mining equipment, including shovels, trucks, drills etc, but also all the minor auxiliary equipment including dozers, graders, cable reelers, etc.

The bulk of the people within the maintenance group are tradespeople. Some tradespeople are hired directly “off the street” while others become tradespeople at the site by working through an onsite apprenticeship program. Teck Coal as well as the rest of Teck Resources has identified a significant tradesperson shortage in the immediate future. Many of our trade’s people are going to retire in the next 5-10 years. As a result of this concern all sites have significantly increased the number of apprentices within the maintenance departments, set trades wages to be the highest unionized wage at the site, improved tool box allowances and applied trade retention bonuses.

Entry into any apprenticeship program requires an individual to first pass an aptitude test specific to the trade being applied for. If accepted the individual starts the apprenticeship by shadowing an experienced tradesperson and attends 4 individual sessions of schooling (25-40 weeks over a period of 4 years in total depending on the trade). In between school sessions the individual is mentored by a tradesperson at site allowing the individual to gain hands on experience to complement the schooling. At the end of the schooling each individual must pass the Red Seal exam and achieve a minimum 70% passing grade.

Most people within the maintenance group work in teams of two or more. They take coffee breaks and lunch breaks together either in the field or in a lunch room. The running repair mechanics attend equipment that requires attention. Unless otherwise requested, by the time the running repair mechanic arrives at the piece of equipment the operator has already been moved to another piece of equipment. For most of the other groups within maintenance the work is done on a scheduled basis. There are a list of tasks to be completed, the mobile equipment is brought in ahead of time for a thorough wash, and placed in the shop. The larger non mobile equipment is left in the field. However in both cases there typically is no operator left with the equipment during the maintenance activity.

In summary the mine operations group is made up of individuals who work in a solitary role with little or no communication with other people in the department while the maintenance group works in teams. The two groups have different educational background, are compensated differently (trades are paid much more than an equipment operator), and throughout the day have very little interaction. Although both groups are measured on safety performance, the mine operations group is also measured on material moved, while the maintenance group is measured on availability of the equipment. These two groups are very reliant on each other, but they work in two different environments with little horizontal connectivity.

2.2 Why the need for a collaborative relationship

So why do the mine operations and maintenance groups have to cooperate? Historically maintenance within mining areas, as well as many other production environments has been seen as a standalone operation, as an “unavoidable nuisance”. Preventative maintenance programs can be viewed in the exact same light as a production order. They both have customers to satisfy and due dates to meet. Break down maintenance can be viewed as being an unexpected customer order, which must be filled in a satisfactory and timely manner. In many cases the tools used for many years in the production planning process are now being applied in the maintenance planning activities. In reviewing dated literature it was very difficult to find references to the importance of maintenance practices in production management articles or books. In the past a number of experts argued that production and maintenance are symbiotic i.e., they are different but interdependent functions, and that the clear priority is for production and that maintenance only exists to supply a helping hand. (e.g., Souris, 1992; Monchy, 1991) However more recent work by Sherwin (2000), and Deluca (1999), has clearly pointed to the need to integrate maintenance with other company functions. They identify that the maintenance function is key in order for a company to increase production capacity decrease costs, as well as optimize quality and safety. It is now clear today, that production is strongly linked with maintenance and vice versa. If the production process is described as something that transforms inputs into outputs with increased value, it’s clear that the maintenance function must be part and parcel of this process.

In order for the overall production system to be successful, maintenance and operations planning must reflect joint assignment of priorities. This process will ensure

that all aspects of both organizations are satisfied as well as to clearly identify any conflicts that may arise. This process will allow the joint ranking of different priorities between the two operations to ensure the correct decision for the overall process is arrived at. In some situations where the reliability of a piece of equipment is decreasing the priority of maintenance of this equipment will increase, and may reach a point where the maintenance priority will take precedent over the production priority until the desired level of reliability is reached.

Another major challenge and benefit associated with better integrating production and maintenance activities is the notion of the “event time” and the “clock time” temporal orientations. A temporal orientation is a cognitive concept that describes how individuals and teams conceive of time (McCarthy, Lawrence, Wixted and Gordon, 2010). Maintenance and operations are governed by both event time and clock time, but not to the same extent. Maintenance is largely driven by “event time” whereby their planning and activities are determined by irregular events such as breakdowns. In contrast, operations are largely driven by “clock time”, whereby they follow the clock and shift schedules. These relative differences in temporal orientations underlie and compound many of the collaborative issues between the two groups. Consequently, appropriate organizational structure and control mechanisms are required to better coordinate the activities of both areas.

As stated by Caldeira Duarte & Maltez (2011, 6) “so far production and maintenance have been managed separately. The results of this are well known, “I produce, you repair”. In order to make optimal decisions operations and maintenance must be fully integrated and the conflict between the two diluted in order for the organization to achieve world class status.

2.3 Evidence that there is a non collaborative relationship

Below is a summary of some of the differences between the two groups and some elements that may have contributed to the current relationship that exists. These elements are a summary of the author's experience combined with interviews from several key individuals within the Teck Coal organization. The interviewees were made up of senior personnel. The first group had extensive experience working strictly in operations or maintenance while the second group has had extensive experience working in both areas. Once the individuals were chosen based on the above criteria, the interview consisted of 3 main topics:

- 1) What frustrations have you seen experienced between the two groups?
- 2) What difference do you see between the two groups and do these differences in any way tie back to the frustrations you have witnessed?
- 3) What ideas or thoughts do you have that could lead to the resolution of these issues?

It was discussed with the individuals whether or not they wanted to remain anonymous. All agreed the intent of what the paper is trying to address is a much needed change and they were willing to make their comments public. While asking the questions posed above, the individuals were initially allowed to freely comment on their perceptions or experiences. Once their initial comments were made, the interviewer at times did probe more deeply on some of the comments made. An attempt was made not to lead the people being interviewed towards any specific direction or conclusions. The paraphrased summaries of these interviews are contained in the Appendix.

For many years it's been the author's experience that both the mine operations and maintenance groups have voiced and felt the frustrations from each other in one on one discussions as well as group discussions at turnover meetings and safety meetings. This experience was common with all 5 people interviewed.

2.3.1 Mine operations

On the mine operations side, operators have been very vocal asking about why required repairs on their equipment take weeks and sometimes months to get completed. Equipment is left in a poor state after maintenance work is completed; grease on the door handles, weld spatter on the windshield, soiled paper towels left in the cab, etc. The operators fill out concerns in the log book, but often the items are not addressed when the unit is in for P.M. and at times after the P.M. is complete the log book is not returned to the equipment. After a period of time the operators have indicated they just “give up” writing things in the book, and just live with the condition of the equipment. There is no doubt that this contributes to a reduction in the level of ownership or caring on the equipment operator’s side. The frustrations get particularly heated when the issues that are not addressed are perceived as safety items. Although direction is given that if something is unsafe do not operate it, this often means the operator is moved off his “normal” piece of equipment onto an older, potentially less desirable piece of equipment, which may cause the operator to choose to “just live with it”, instead of shutting it down.

2.3.2 Maintenance

On the maintenance side, the tradespeople are frustrated, and express this verbally at meetings, that they are not given the time to complete all repairs, they either don’t have the parts or time available, or the equipment is rushed back out into the field because “operations needs it back”. Tradespeople are also witness to clear signs of abuse, bent ladders, broken windows bent hand railings, none of which have been reported as incidents. These unreported incidents or situations help promote the perception of the tradespeople “if the operator doesn’t care, why should I”.

2.4 What is the source of the combative relationship that currently exists?

In this section this paper will summarize some of the situations that may have contributed to the relationship as it currently exists. The current issue faced between the operations and maintenance groups did not form overnight or even the past few years but has developed over decades of experiences in the Elk Valley and likely elsewhere in the world. Bolman and Deal (2003, 42) stated “When teams work badly they often blame each other for problems that reflect structural rather than individual failings”. From the interviews conducted one of the interviewees mentioned that “worlds are often built on

perceptions”. Both of these statements describe what has been observed between the mine operations and maintenance groups within the mines at Teck Coal. The two groups in general are made up of people with different backgrounds, and different levels of experience and expectations. Listed below are the “differences” identified between the two groups.

2.4.1 Mine operations

- Typically the operations group is made up with “blue collar” workers. Many of the mid level or more senior level operators did not finish high school. Hiring practices have changed over the years such that in particular with younger applicants the minimum education to be considered is Grade 12. Although this requirement may still be waived if the applicant has significant previous experience.
- Operations positions are considered to be entry level positions. The bulk of the operations group is paid at the lowest level within the union.
- Operations people tend to realize that they need their job at the mine and plan on staying with it until they retire. For many operators, the high wages they are paid are a major factor in choosing this vocation. Given their level of education, there are few other opportunities that compare.
- Operations people tend to blame the system as opposed to any one individual for a failure to repair a piece of equipment. There are frustrations amongst the group that there is a lack of effort amongst the maintenance group to address, “operator comfort issues”. When these items are not fixed, there is rarely any feedback to the operator as to why the issue was not address or when it will be completed.
- When mine operations foremen are chosen the vast majority come out of the equipment operator group. Historically the main metric that is driven home with this group is productivity and safety. Apart from safety, the focus of this group even at the senior foremen level is limited to the number of truck loads of material hauled for that shift.
- Equipment operators are monitored via the computerized mine dispatch system virtually every minute of their shift.

- When a foreman is selected and starts on shift, he is working directly with other experienced foremen (at the larger mines) and a senior foreman. This structure provides a good opportunity for guidance and mentoring of new foremen.
- Any interaction between operations personnel and their foremen is typically quite impersonal, over the radio, over the dispatch computer or when the foreman addresses the entire group as a whole at the start of the shift. Operations personnel are expected to take their lunch breaks alone on their equipment. This tends to create a culture where the group tends to act as individuals as opposed to being part of a team.
- Historically the operations group has been strictly judged on its ability to produce. The recent addition of the mine dispatch system over the past two decades has made material moved per day, per hour, per man shift key performance indicators all very easy to obtain track and review. These statistics are drilled down even further to the individual pieces of equipment and compared against average haul distances and in many cases taken to the level of the individual operator.

2.4.2 Maintenance

- Tradespeople go through a 4 year apprenticeship program which involves classroom schooling away from the site as well as hands on training and are required to pass a final exam attaining a minimum 70% passing grade.
- It is no secret amongst this group that tradespeople are in very high demand. As a result many tradespeople feel that the mine needs them more than they need the mine. As a result of the demand for tradespeople they are compensated at the highest rate within the union and are given a substantial tool allowance and retention packages.
- All maintenance personnel are permitted to leave their work area and go to a lunch room where microwaves are often provided. In general they are mainly self supervised throughout their day. Breaks are taken in groups where social interactions can and do take place.

- Through their schooling they are taught and work under the idea that every job must be completed thoroughly and properly. Their key driving indicator is job quality as opposed to how quickly the job is done.
- Maintenance personnel tend to blame individuals (in operations) for any failure to reach acceptable availability or reliability targets as opposed to blaming the system. There is a perception amongst the maintenance department that operators lack any sense of ownership of the equipment. If their unit breaks down, they are simply moved to another piece of equipment.
- Maintenance foremen are put out on shift with minimal support. The general foreman (their direct supervisors) work 5x2 (Monday – Friday) whereas the maintenance foremen work a 4 days on 4 days off schedule (some days and nights), so the opportunity for mentorship from the general foreman level is limited. The current structure as it exists has the maintenance foremen doing a large amount of paper work and locating parts. Currently through the Maintenance Performance Improvement Initiative this aspect is being addressed.
- Interaction between the maintenance personnel and their foreman is typically face to face. Crews also work very closely together during the day and eat lunch together, which creates a greater feeling of “team” amongst the group. A down side is that negativity can spread much more easily through the maintenance group due to the continuous interaction between the individuals.
- While there are well established high level key performance indicators within the maintenance group, they are difficult to drill down on much below an equipment availability level. Individual performance metrics are difficult to quantify. Efforts are underway to expand metrics more towards reliability as opposed to simply the availability of equipment, however they do not currently exist. The equipment in the mining environment is very large, and many jobs require more than one individual and go beyond one shift to complete, as a result any key performance indicators by crew or individual are difficult to quantify. Evaluating the performance of an individual is at best qualitative.

In summary both the mine operations and maintenance groups are well entrenched in “the blame game”. If the operations group is successful during the shift, they received accolades for doing a good job. If targets are not met, a typical response is to blame the weather or the maintenance group. If the maintenance group has not met its targets for a day or a month, a common explanation is that operations has been mistreating the equipment or not making it available for maintenance when requested.

It is clear that a collaborative relationship is required between the operations and maintenance groups in order for both groups to succeed and become world class in their respective fields. It became clear through the interviews that there is a lack of understanding between operations and maintenance as to how each area functions, and the impacts that each area can have on the other. There was also general agreement with the interviewee’s that reward systems must be carefully examined. The right reward system can bring the two groups together; the wrong one will drive them further apart. This aspect is more deeply explored later.

3.0 Recommendations

In this section this paper will summarize 7 solutions arrived at through the interview process. During the interviews conducted, the final question as mentioned above was posed as “What ideas or thoughts do you have that could lead to the resolution of these issues?” From the interviews conducted the author received direct suggestions as well as pursued discussions (not necessarily listed under suggestions in the interview notes) that could be implemented to break down the silos that have developed between the mine operations and maintenance groups. No one thing in the list below is going to act as a “silver bullet” in changing a culture that has been years in the making. In order for this change to be sustainable it must be supported from the top and be employed with enthusiasm throughout everything that is done between the two groups.

3.1 Senior management commitment

Throughout the years it has become popular for both mine operations and maintenance to “slam” the other department when things go wrong. Recently the author experienced a mine operations senior foreman taking a new foreman on his first day on a mine tour with the specific goal to show the new foreman “how inefficient maintenance is”. The propagation of this poisonous attitude must be stopped in its tracks and must begin at the highest level. Senior management can demonstrate this commitment by “walking the talk” and pushing this down through all levels of the organization such that each group supports the other. While these are just words, it’s where the site must begin to bring the two groups closer together. A first step on this difficult road is to explain to the first levels of management the challenges faced by the maintenance department and the importance of breaking down the silos that have been created over decades to create the animosity that exists today. This in itself is not a large step but a critical one without which everything else identified will not achieve the success desired or be sustainable.

3.2 Increased resources in planning and scheduling

One of the key areas identified in the interviews conducted involved a lack of field supervision within the maintenance group. Over the years, the maintenance foreman’s efforts in supervision have been significantly diluted by other aspects of the job including paperwork, planning and chasing parts. Through the Maintenance Performance

Improvement Initiative this was identified as a key finding and is in the process of being rectified. At Elkview five new planning/scheduling positions have been filled and training of these new people has begun. The successful individuals for the planning positions were chosen out of the trades group due to their expertise in their individual areas. Filling these positions is key to allowing the maintenance foremen to improve contact with their people and the operations groups in the field.

3.3 Provide mentoring of maintenance foremen

Maintenance foreman (and to some extent operations foreman) have historically been chosen based on their technical skills as opposed to their management skills. Now that the foreman will have the time to directly supervise their people increased effort will have to be made in order to mentor, coach and guide them. In some cases habits have been formed because of a lack of supervision, which will be challenging to correct. The maintenance foremen will need to be armed to deal with these situations. Teck Coal during 2010 provided “Supervisory” training for all foremen and the program will be extended to lead hands (back up foremen) during 2011. Providing this type of training is critical to the foreman’s success but the training must be supported by senior management.

Selection of future foremen needs to be re-examined. In operations and maintenance groups, the best equipment operator or best tradesperson do not necessarily make the best foreman, the two roles require different skills. In the authors experience for mine operations, the best foremen used to be only “average equipment operators”, but clearly possessed strong communication and people management skills. Although you need to have a good knowledge of equipment and maintenance practices to be a strong foreman, these attributes are not paramount for success. Having exceptional people and communication skills are much more important in the role of a supervisor.

The maintenance general foremen at most sites are very strong people oriented leaders within their groups. However because of the schedule they are working their contact with the foremen of the various different maintenance groups can be quite limited. It will depend on the current structure of the operation, but it is critical that a new foreman is provided with continuous mentoring while he is “learning the ropes”. Currently it is typical that a maintenance foreman begins on “running repair”. This crew works 4x4 days and nights and as a result has the least contact with the next level of supervision,

which is the general foremen who work a Monday to Friday schedule. At the larger operations it may be appropriate to have a senior foreman level created on shift similar to that in the operations group so that coaching and mentoring could be provided to all maintenance supervision on the shift. Where this is not practical the senior foremen in the mine could potentially help to provide this coaching role with a dotted line relationship back to the maintenance group.

3.4 Creating a lower level connection between the two groups

Galbraith (1994) discusses the beneficial use of “boundary spanners”. The purpose of a boundary spanner is to manage the flow of information across boundary lines between two different groups. This function is most effective when the two groups have very different tasks and possess very different perspectives. The main function is to collect, filter and disseminate knowledge across boundaries, but more importantly they can engage in relationship building, develop shared goals and knowledge as well as develop mutual respect amongst fellow workers.

From the literature reviewed as well as comments received from the interviewees both identified the need to create a more formal connection between the two groups at levels below the general manager level. All agreed that this in itself would have some challenges. Two of the suggestions provided were:

- Create a “manager of operations and maintenance” position. Where both groups report to one business head who would report to the general manager. This structure has recently been put in place at the Fording River operation (manager of operations maintenance and engineering) and has been in place for many years at Teck’s Highland Valley operation.
- A second more controversial suggestion was to have the running repair group report either directly to the operations group or at least be connected by a dotted line reporting structure.

Under the first suggestion, concerns were raised about the general manager losing his own connection with the groups by having an additional level added to the organizational structure. With changing the structure of the running repair group such that they report to the mine operations group it was felt that there may be some fragmentation of the maintenance group and may not be a healthy result. The goal of this type of restructuring is to achieve the right amount of horizontal structure as

compared to vertical structure. This will ultimately be a site by site decision. Larger sites may have to formalize a lower level horizontal structure where as a smaller site may be able to accomplish something similar by utilizing focus group meetings on individual problems (discussed below).

3.5 Cross functional meetings

This step will likely provide the greatest benefit and would be the easiest to initiate. If formal horizontal structure is not practical or possible, more informal horizontal links can be created. From Bolman and Deal (2003) they discuss that successful organizations coordinate individuals and group efforts to link local initiatives and corporate goals.

- Vertically through a formal structure. This already describes the typical structures within Teck Coal.
- Laterally through meetings, committees, and coordinating roles. Within Teck Coal these are beginning to form but more are required.

Anand and Daft (2007) discuss that very few organizations can be successful with a purely “functional” or vertical structure. This type of structure will naturally create “silos” that inhibit the amount of coordination needed in today’s changing competitive environments. Developing horizontal structures advocate the dispensing of internal boundaries that are an impediment to effective business performance. To this end there must be connections made throughout the organization to create lines of communication back and forth between mine operations and mine maintenance at as many levels as possible.

In order to bring the two groups closer together some cross functional meetings need to be developed. One of the key items identified with most of the interviewees was the general lack of understanding between the two groups of each other’s business. Cross functional meetings that become a routine part of day to day activities will help to increase the level of understanding between the two groups as to how they each function, and what each needs to be successful.

An example of one success in this area at Elkview resulted from a recommendation from the Maintenance Performance Improvement Initiative. One of the meetings developed was a weekly maintenance K.P.I. (key performance indicator) meeting. After the meeting was established it was identified that having operations

present would provide value for both communication of the results of the K.P.I.'s as well as to receive input from the operations group on issues that were affecting the maintenance group. Initially operations attendance was only at the superintendent level but progressed such that the general foreman and the senior foreman on shift both attend as well. The results of this inclusion have been identified as very positive from both the operations and maintenance groups. The maintenance people greatly appreciated hearing from the operations group what their priorities were and why. The operations group was pleasantly surprised and impressed at the level to which maintenance was monitoring their own success and how critical they found the input from operations to be.

In order to drive the horizontal information sharing and cooperation into the organization such that it becomes part of the cultural change it will take more than one meeting to be successful. Listed below is a series of meetings that should be implemented and scheduled between the two groups.

3.5.1 Daily meetings

At Elkview both operations and maintenance used to have their own turnover meetings at the start of every shift. An attempt was made to combine them to share issues and challenges. Unfortunately over a short period of time maintenance began leaving the meeting after they covered their own concerns then went off and had their own meeting anyway. It will be important that these two groups meet daily to review issues and challenges that were presented during the previous shift and those they will face during the next shift. Although this meeting currently exists at Elkview it does not provide the connectivity that is required.

3.5.2 Weekly meetings

At Elkview the maintenance group has a very efficient well formatted and well attended K.P.I. meeting (discussed above). The mine operations group needs to establish supportive K.P.I.'s (deeper than just loads per shift) and incorporate their K.P.I.'s into the same or similar meeting such that they can be shared with the maintenance group. When it is decided that the mine should have their own K.P.I. meeting it will be critical that maintenance is in attendance. Either way it's critical that there be both passive and active involvement between the two groups.

3.5.3 Pre P.M. and post P.M. discussions.

Many sites are doing these at one level or another. Maintenance of all major equipment must include both Pre and Post P.M. discussions with the operators of all the equipment. These discussions have proven successful at Elkview with the haul truck operators but must be extended further to the other pieces of equipment. Prior to a truck going in for P.M. a maintenance representative meets with the haul truck driver on the piece of equipment and reviews the issues identified in the P.M. book to ensure he understands what is required. After the P.M. is completed the same representative meets with the operator (not necessarily the same operator from the pre P.M.) to evaluate if everything was completed to the operators satisfaction. Each piece of equipment is operated by a minimum of 4 different operators (one per shift), and the logistics of trying to meet with the same operator for both pre P.M. discussions and post P.M. discussions is very challenging (and may not be necessary). Where possible these discussions should include both the operations and the maintenance foreman. Although this may be a challenge for the more numerous equipment operating groups like haul trucks and dozers, it should be easily accomplished with the major equipment like shovels and drills.

3.5.4 Focus group meetings

At times various operations have had success in creating focus group meetings between specific areas. For example, bringing together the driller operators with the drill mechanics and the shovel/drill maintenance foremen to discuss specific interests or challenges either group faces. These meetings need not be done on any specific schedule but can be initiated when ever issues arise with regard to availability or reliability issues, or if concerns are raised with regard to the overall condition of the equipment. Too often these issues are dealt with within each group in isolation. Bringing the groups together will again provide a connection between the two groups and allow them to understand the challenges faced by each other on a day to day basis.

3.5.5 Quarterly meetings

Quarterly foremen meetings have been held with some success. These meeting need to happen on a regular basis but more importantly the focus of the meetings must move away from senior management “talking” to the foremen and move towards foremen talking to each other. Although a quarterly meeting is a great opportunity for

senior management to address the groups and provide information as to the “state of the ship” a focus must be turned toward interdepartmental communication. At each quarterly meeting, individual groups should be tasked with preparing a presentation for the upcoming meetings presenting specific challenges they have in their areas with the goal of eliciting suggestions from the groups on how to resolve them.

3.5.6 Open discussions on incident investigations

Several of the people interviewed felt that there was a different standard between the operations and maintenance groups with regard to how they treat/deal/accept various different types of equipment damage or incidents. The Greenhill’s operation feels they have been successful in this area by committing to involve both groups in the investigation process of all types of equipment damage. This activity will help to make the process transparent to all involved and help to develop a common approach to how equipment damage is dealt with between the two groups.

3.6 Cross functional training

Nearly every person interviewed identified the need to have each site “walk a mile in the others shoes”. Experiences need to be shared such that each group knows how their actions affect the other. In the past at Elkview there was a formalized training program for operations foremen where they spent time at the plant, relevant maintenance departments, and in Engineering. Unfortunately due to the high turnover rate experienced in this group over the past 5 years, this program fell by the wayside. This process needs to be resurrected. Although it may vary depending on the operation, during the training stage of any new foremen, each one must spend time with:

- The operations foreman or senior foreman in the mine
- Running repair foreman
- Shovel and drill foreman
- Truck shop foreman
- Plant operations foreman
- Engineering (planning)
- Geology
- Environment.

Although this training program may start with spending a 12 hour shift in each area this alone will not create the understanding required. For the operations and maintenance group, it may require them to spend additional time with their key counterparts to help develop the contact and connection required to break down the silos that have been created. Historically it has been rare for a foreman in one area to laterally move to another area on a permanent basis. This cross functional training may also help to promote this type of lateral movement which would greatly enhance the ability and knowledge of the individual involved in the transfer and would also aid in improving the cross functional understanding between the two groups at the operation.

3.7 Reward systems

During 2010 within Teck Coal a series of objectives were identified that contributed to the overall bonus program. Reward systems can change and develop over time. Whenever a reward system is established or changed it will be critical that the objectives identified are structured such that they support the collaborative relationship between the operations and maintenance groups and not drive them further apart.

Historically operations groups have been measured on material moved per day, per hour or per man shift, and maintenance groups have been measured on the overall equipment availabilities achieved. Maintaining focus only on department specific objectives will continue to drive a wedge between the two groups. As identified previously it becomes far too easy for each area to blame the other for their failures. During 2010 attempts were made to move beyond this historical structure and had maintenance foremen rewarded on material moved per day and operations foremen rewarded on P.M. compliance. This approach is far more conducive toward creating a cross functional responsibility between the two groups as long as the individual is clear on how he can impact the outcome. If reward systems are in place, wherever possible a site must attempt to create a portion of the reward system in a cross functional manner to help encourage the collaborative nature they are trying to achieve. These cross functional reward systems will help the mine operations group feel they have a part to play in the success of the maintenance group and the maintenance group will experience the effect that they can have in the success of the operations group. Care must be taken however, if the incorrect rewards are utilized employees may tend to break through existing control measures to achieve a localized feeling of success and ultimately put the business in jeopardy (Simons 2000).

In summary I have presented seven action items to help develop a collaborative relationship between the mine operations and maintenance groups. The goal of these action items is to initiate sustainable cultural change.

4.0 **Implementation of cultural change**

In this chapter I will use Kotter's approach to leading change (Kotter 2007) to lay out 8 steps in order to successfully implement a successful cultural shift involving both the mine operations and mine maintenance groups within a coal mine at Teck Coal. The tension between the operations maintenance groups has been developed and in some cases encouraged for over 30 years. The ultimate goal of creating a cooperative relationship between these groups at any of our open pit coal mines will require a significant cultural shift throughout the organization. Doing any one of the actions items listed above will not alone accomplish a change in the currently entrenched culture. The work involved in changing a firmly entrenched culture of this magnitude cannot be underestimated and will require a significant change in the way of thinking of virtually everyone within the organization. If this topic is taken too lightly the desired change will not take hold, and minor changes in personnel will send the culture back to the way it was before. A truly successful cultural change is very difficult and requires the commitment of the entire organization, and must start from the top. A successful cultural change will remain even if there are significant changes with personnel at any level of the organization.

Kotter's (2007) paper entitled "Leading Change" outlines 8 things that successful leaders do in order to successfully accomplish cultural changes within their organization. Each step is outlined below as it would refer to Elkview Coal, however this approach could be utilized at any of the mines within the Teck organization as well. Kotter stresses that not only should all 8 steps be followed as a frame work, but they also must be followed in the correct order, they cannot be rushed and steps cannot be skipped. Skipping steps may create the illusion of speed while negating some hard won goals in the process. Although the illusion of success may be achieved more quickly it will not be sustainable.

4.1 **Step 1: Creating a sense of urgency**

In order to begin down a path of significant cultural change everyone involved must recognize how difficult the path will be. This is not something that will require a couple of catch phrases, a few meetings and take a week, a month or even a year. According to Kotter (2007), it's at this phase that greater than 50% of organizations fail at instituting cultural change. It must be recognized that this process will require dedication from everyone involved and will have to begin within the highest levels of the

organization. For the purpose of introducing change with the Teck Coal business unit, this commitment will have to start at the general manager and superintendent level. People will have to “leave their comfort zones” and be willing to accept issues within their own areas and be willing to change.

The first step is to openly discuss where we are today with regard to the relationship between the two groups, but just as important is to identify what we are trying to achieve and the benefits that a collaborative relationship carries in order to achieve the goal of becoming a world class organization.

An example of this at Elkview could be that this process should begin with presenting the successes achieved thus far within the truck shop itself to the entire Elkview site. Pre P.M.s as well as improved planning and scheduling have allowed the number of maintenance tasks completed in a week to rise from a historical average of 15-20 up to the new norm of 40-50. Truck drivers have commented that all jobs identified are now getting completed during P.M.’s. With the recent plant upgrade nearing completion, as well as some unplanned geological complications, the operation is very quickly moving from being “plant limited” to “mine limited” in terms of its ability to produce. Early indications are that new equipment forecasted to aid in increasing the mines production may not arrive on schedule, so it will be imperative to improve the available hours and the reliability of the existing equipment. Without continued improvements in the availability and the reliability of the equipment there is a chance that production could be significantly impacted.

4.2 Step 2: Creating a powerful guiding coalition

Elkview is currently going through a restructuring in order to better manage future challenges in all areas, specifically training, safety, and environment. However another goal of the restructuring is to help the site in general to achieve “operational excellence”. To aid in this journey a group will be formed with members from most areas of the operation (mining, maintenance, processing and engineering). These individuals will be pulled out of their normal reporting structure to be able to focus on blazing the path towards operational excellence and will have line of sight to senior people in the organization. This group at Elkview will act as the guiding coalition in this cultural change.

4.3 Step 3: Clearly identify the vision

Through the maintenance improvement initiative the vision for the site has been well stated and understood within the maintenance group itself. “Doing the right thing every time we will lead our industry in having the right equipment available, at the right time, and at the right cost.” This vision must be just as well understood within the mine operations group. In order for this to be meaningful to the operations group, there must be a plan to clearly demonstrate “what’s in it for me”. Sites as old as Elkview (+40 years) over the years have had their share of buzz words, programs, and cliché’s. Just stating what at first may appear to be “just another slogan” without describing the path of how to get there will have more of a negative effect than it will to promote the cultural change desired. The vision statement for the operations group must be accompanied by some level of detailed mapping of the plan going forward, with some ideas as to the changes that will be made in order to accomplish the plan.

Some examples of changes that have been made at Elkview to achieve the desired objective are for instance:

- the appointment of pre and post P.M. foremen,
- The appointment of the different levels of planners and schedulers to free up the maintenance foremen from being tied to the office and allow them to begin leading their teams.
- The detailed K.P.I.’s being tracked and reviewed in maintenance as well as the introduction of K.P.I.’s for the operations group.

The execution of the changes listed above are important but communication of the changes and what the intended outcome is to be, is critical to the success of the changes. Doing all these things will not only help to achieve the final vision but will create a level of believability within the operations group and help to begin to develop some level of buy in.

4.4 Step 4: Adequately communicate the vision

Even if step 3 is accomplished with vigour and believability if it’s the last people on the floor hear about it or even worse the site appears to be doing things counter to the vision, it will quickly fall by the way side. This vision must become part of every quarterly, monthly, weekly and even daily meeting. As described earlier in the paper, the

maintenance group has been successful in their presentation of the weekly K.P.I. meeting in that they have been able to include the operations group, not just to listen but to actually provide input as to what they need from the maintenance group. Extending off this success, the operations group must be presenting their own K.P.I.'s at this weekly meeting, and also incorporate the performance levels achieved into daily discussions with their groups, always referring back to the guiding principal of working together to achieve excellence.

4.5 Step 5: Remove obstacles to the vision

Obstacles to the vision can take many forms. They can consist of existing site structure, individuals, procedures, past practices, or reward systems that contradict the vision.

At Elkview the existing site structure was identified as one obstacle. The structure is going through one metamorphous where additional scheduling and planning roles have been created to allow the foremen time to coach, guide and lead their people. Procedures and past practices is another area that has been looked at and clearly requires updating and further review. The institution of pre and post P.M.'s on all equipment will be critical to the success of the program. If any individuals are identified as being obstacles to the vision they must be identified and their issues dealt with, not just ignored. One key player in the organizational structure who does not support the vision can prevent the entire site from progressing. To this end, "old school" thinking (i.e. individuals who do not support the vision of the two groups working together) in either the mine operations or maintenance group cannot be tolerated. If individuals are not able to change the way they approach their work, they may not be able to remain in their positions.

Reward systems that are misdirected can easily force people to make poor decisions. For example an operations foreman who is rewarded strictly on loads per shift, may choose to run a piece of equipment to failure to achieve that last dozen loads. A mechanic simply rewarded on P.M. compliance may be reluctant to release a piece of equipment early that is badly needed by the operations group. Reward systems must be structured such that they support the vision. As discussed earlier a cross functional reward element should be considered where the mechanic is rewarded for helping the operations group by being flexible in providing the equipment required, and the operations foremen should be rewarded for helping the maintenance group succeed.

4.6 Step 6: Create a plan for short term wins

In order to create momentum it's critical that short term wins are created, planned for, communicated well and celebrated. In this application, a short term win may not be the same for the maintenance group as it is for the operations group. For the maintenance group, one of the recent short term wins was the increase in the number of jobs completed per week in the truck shop. In order to accomplish this goal, the operations group had to give up the trucks for about 45 minutes for the pre P.M. and another 30 minutes for the post P.M. Certainly there was positive feedback from the equipment operators themselves in that their issues were being repaired and they felt involved in the process, but eventually all this work must result in improved availability reliability or cost, otherwise it is a meaningless win as far as the operations group goes. To date these resultants are not yet well understood, and as a result have not been communicated to the operations group.

Other K.P.I.'s within the maintenance group are showing some positives trends as well, but as with the truck shop jobs; there has been little or no connection to the operations group. Eventually these "wins" must be tied to tangible results for the operations group or forward momentum and support will be lost. If groups are left to make their own connections between results, they can often make inaccurate links. An example that Kotter (2007) uses is where a group is successful and the success is linked to an individual who is leading the group. The success of the group is linked to the individual instead of the process that was put into place. When the individual leaves, the group feels they have lost momentum because of the loss of the individual, as opposed to seeing the strength in the systems that have been created.

4.7 Step 7: Use short term wins to gain momentum for additional and deeper change

True cultural change takes many years to take hold. According to Kotter, one of the great risks companies face when attempting to create a cultural shift is to declare victory too soon. During the early stages of cultural change, new processes, and victories are very fragile and can take a backward slide over seemingly insignificant events. True leaders in change will continue to utilize short term wins but always look for the opportunity to look deeper and deeper into the site structure and processes employed to identify areas that are not fully supporting the change or the new culture that is trying to take hold. Hiring practices within the organization must support the new

vision. A strong personality brought into the structure that was making significant progress can easily bring that progress to a halt. The already weary group of supporters may see this as an opportunity to give up and go back to “the way we used to do things around here”.

4.8 Step 8: Anchor change to corporate culture.

In order to anchor the change achieved an organization must continue to report on, and link short term and long term wins to the culture that has been developed. Ultimately successful cultural change cannot be linked to any one individual. Individuals will change and a strong cultural shift must become so deeply embedded in the structure, processes and hiring practices that a change with personnel will not proceed unless the individual believes in and personifies the new culture. Even a firmly developed culture can be crushed by placing the wrong person at the helm. As a result succession planning within the organization must take into account the new fragile culture that is in place.

5.0 Conclusions

In order for the entire business unit to achieve operational excellence, Teck Coal will require a world class maintenance organization. This paper has identified that a critical step in this process is that each site must develop a collaborative relationship between maintenance and operations that ensures joint responsibility for the condition and effective operation of equipment in order to achieve the vision of

“Doing the Right Thing – Every Time

We will lead our industry in having the right equipment

Available, at the right time, and at the right cost.”

The existing culture and misalignment between the maintenance and operations groups has been decades in the making. In order to implement change that will last substantial changes deep within the organization must be committed to at the highest levels to be successful.

In order to identify the path to be taken the current structure of the organization within a coal mine at Teck was studied and evaluated. As well, a series of interviews were conducted with individuals who have substantial experience within the operations and/or maintenance groups. Questions were posed to try and understand where and how the existing culture was developed, and where the frustrations between the two groups exist. Identifying the issues between the groups has led to areas where the groups can be brought closer together. The recommendations identified include:

- 1) Ensuring Senior Management Commitment.
- 2) Restructuring of the maintenance group to allow for change.
- 3) Development of cross functional meetings to bring the groups onto common ground and to develop greater horizontal communication and cooperation which should ultimately lead to greater innovation.
- 4) Implement cross functional training between the groups to allow each other to understand the challenges faced and further enhance horizontal communication.
- 5) If available, evaluate reward systems to ensure they support as opposed to undermine the vision.

Kotter and others have determined that truly long lasting deep cultural change is rarely successful within a large organization. The implementation stage of any change is absolutely critical to its success. Kotter's paper "leading change" was used as an 8 step framework in order to help initiate the change in culture within Teck Coal, to gain momentum and drive the new culture deep within the organization such that the new culture will remain through any change the organization may face.

Appendix

The following Appendix contains summaries (paraphrased) of interviews conducted and all have been reviewed with the interviewees for accuracy of interpretations resulting from the discussions held.

Don Sander

Don has 24 years of mining experience at multiple coal operations within. He spent the first 20 years working his way up on the maintenance side from Maintenance engineer up to maintenance superintendent. Don then spent about a year and a half as an Operations superintendent and now has spent the past 3 years as General Manager of our Line Creek Operation.

Frustrations of each of the Maintenance and Operations groups.

- Maintenance with Operations
 - How operations treats the equipment. They only care about getting through to the end of the shift. Warning lights are taped over, alarms are continuously reset in order to not have to change to a different (potentially older unit) to run for the rest of the shift.
 - Maintenance personnel want to fix these units before they become a more serious issue (potentially more work to fix).
 - They feel operations demonstrate a lack of ownership of the equipment. This attitude is promoted when their unit does go down there is nearly always another unit for them to operate.
 - There is a difference between being an operator and a driver. An operator will care about his equipment, monitor its condition and put it down when it's appropriate to do so. A driver will drive until the unit it breaks then ask for a new one ("it's not my problem" attitude). In the past (10 years ago) the average experience level of a truck driver was around 5 years, but due to expansion and high levels of turnover, the average truck driver has been with the operation for only 2 years. This fast progression does nothing to promote ownership in the equipment.
- Operations with Maintenance
 - Operations feel that the equipment should be fixed in a timelier manner. In particular operator comfort items. The operator has to

“live” in the equipment for 12 hours each shift, so a drafty or cracked window can be very annoying. They feel that these items are not a priority for the maintenance group.

- There is a lack of feedback from the maintenance group. Items are identified in the “pre PM book” and not repaired with any explanation as to why or when. As a result they stop reporting the problems because they feel “nothing will happen anyway”.
- Operations feels maintenance people are pampered prima Dona’s.
 - Operations take their lunches in their equipment where as maintenance people go to a lunch room where they have microwaves.
 - Maintenance personnel are paid more per hour and have tool allowances and provided retention packages.
 - They appear to spend the better part of their day waiting around in their trucks waiting for jobs to be done or waiting for parts.
 - They are not continuously under the foreman’s eye like the operations group is.

Differences between the operations and maintenance personnel.

- Maintenance group
 - Interaction between personnel and their foreman tend to be much more face to face.
 - Maintenance people have lunch together. Whereas operations people eat lunch on their own.
 - The feeling of team is stronger especially when it comes to cases of discipline. If one individual gets written up the supervisors must manage the crew effectively as there can be a more disruptive reaction; i.e. - the entire crew slows down a bit.
 - The foremen in the maintenance groups are chosen based on their technical skills. These skills do not necessarily mean the individual has the skills to coach lead and guide a group of people. When foremen are chosen there is little support provided from a mentoring point of view.

- Operations Group
 - Interactions between personnel tend to be over the radio or computer or at the beginning of the shift where the foreman is addressing the entire crew. Face to face communication is limited.
 - The group tends to act for the most part like individuals.
 - The foremen progression line is better suited for mentoring.

What ideas or thoughts do you have that could lead to the resolution of these issues

- Consider having combined Operations/maintenance supervision. Will need to watch that we don't over extend the individual.
- Pre P.M. and post P.M. are very important and improve communication.
 - These are an opportunity for the mechanic and operator to interact directly with each other; both before the work gets done as well as after it's completed to ensure all issues are addressed.
- Senior Management has to put a stop to any "cross talk", meaning any derogatory comments about one group or the other.
- Try and rotate the foremen from each group into the other to create a higher level of understanding. Doing this for 1 shift would be a good start, but will likely take longer to have the full effect (potentially spend time in the other department once per month or once per quarter). Where feasible promote foremen changing departments. "Worlds are built on perceptions". Each foreman walking a mile in the others shoes may help to "true up" these perceptions.

Dan L'Heureux P.Eng. Superintendent

17+ years of experience has covered 3 of the 6 mine sites within the Elk Valley. He has held positions as department head of Engineering at Line Creek, Maintenance and Operations at Fording River.

Frustrations of each of the Maintenance and Operations groups.

- Maintenance with Operations
 - Operators break stuff. Sometimes seen as poor training/operating practice leading to unnecessary breakdowns. Maintenance having to do work that shouldn't have been required.
 - Cannot fix items properly; lack of planning, workload (fix the must do's and kick it out!), hard to find parts (inefficient parts catalogue, warehouse system), lack of parts.
 - Leaving broken items too long between repair intervals increases repair effort, cost required and downtime (which maintenance is measured by as one gauge of success).
 - Lack of interesting trouble shooting work to challenge their skills and training. "Contractors get all the interesting work and we just do P.M. work".
- Operations with Maintenance
 - Not having enough equipment running to meet their objectives (production)
 - Equipment leaving the shop and it's not completely or properly repaired.
 - Creature comforts' are very important to the operator (they spend 12 hours every work day in their equipment environment). How would you like to drive to Winnipeg, without an FM radio for distraction? Due to time pressure, lack of available parts or 'can't find the problem', maintenance sometimes releases equipment without the creature comforts addressed.

Differences between the operations and maintenance personnel.

- Maintenance group
 - The two groups function differently and have different motivations. Many frustrations are similar but there are some that are in common.
 - Maintenance tends to blame individuals whereas operations tend to want to blame the (maintenance) system.
 - Maintenance people tend to view themselves as more portable. "I don't need this company, they need me". Initially they tend to be more motivated as they have gone through substantial schooling to attain their trade.
 - Work in pairs or groups. Group activity leads to reinforcement of complaints. One loud complainer seen as a leader affects an entire

group. Easier to be seen as a complainer, supportive people can look like company suck ups.

- They are driven to fix the equipment properly and completely and get frustrated when they cannot do this due to workload, lack of planning etc.
 - Negativity spreads much more easily within the maintenance groups as they spend much more time working together.
 - Trade school.
 - Independent certification leads to a sense of portability. This in turn affects attitude, (especially when the resource sector is booming) 'I can get a job anywhere if I don't like it here'.
 - Opinion of Mine Operations Personnel: ranges from 'good guy' to 'bad operator (rough on equipment, can't describe the problem he is having).
- Operations Group
 - Operations are not as portable. They need the job as they have no education.
 - Negativity does not spread as quickly as the operators tend to work independently.
 - Solitary. Creates tendency towards stronger individual opinions that get voiced in group settings as opposed to 'follow the leader' mentality. Influence (positive or negative) tends not to spread to the broader group.
 - In-house training, mine site based, no outside certification trade school).
 - Lack of independent certification leads to a sense of lack of portable skills. This leads to 'I need this job' which in turns affects attitude 'let's work together to make this work, I need for this to work'.
 - Opinion of maintenance personnel: ranges from 'good guy' to 'prima donna' or 'crappy mechanic (can't find the problem I'm experiencing)' also sense of entitlement, 'they get tool and tool box allowances, what do I get....gloves?'

What ideas or thoughts do you have that could lead to the resolution of these issues

- Cross functional training leading to walking a mile in the other's shoes would be the approach I would support the most effort on.
 - The key is to be able to identify leaders within each group that are willing to participate and openly share with others, otherwise the learning from the experience is confined to only those directly involved.
 - It is one thing to be frustrated that everything didn't get fixed on your truck while it was in the shop but it is another to find out your minimal effort of describing the problem in the log book leads to

maintenance not being able to find the problem despite spending ½ hr looking. It's also one thing to say 'it's just the radio' and a whole other thing to spend an entire night shift with no FM radio for distraction and a crew that tells you to cut the chatter on the 2-way radio.

- This would be more effective if it was repeated, say 3 times over a one year period but not carrying on as a permanent feature. Need to change it up over time or it becomes stale.

Ed Morash

Ed initially began his career in the north east coal deposit at Quintette as maintenance planner. In the valley he worked at the Elkview mine for three years as an assistant superintendent of maintenance before transferring to the Line Creek Operations as Maintenance superintendent for 2 years. He then transferred back to Elkview as the Maintenance superintendent then spent about 1 year as the Mine Manager at Elkview before moving to the Fording River operation as Mine Manager in charge of Operations, Maintenance and Engineering.

Frustrations of each of the Maintenance and Operations groups.

- Maintenance with Operations
 - They want to fix every issue raised by the operator, but are not given the time.
 - Running repair has a good connection with the operator but the shops do not. They get a list of items to repair but do not have a good connection with the operator on the equipment. They just want to complete their list, but they don't have the time or the parts available.
 - Any sign of operator abuse (or perceived operator abuse) causes them to just give up or not care. There is a certain level of damage that is to be expected with mining. They need to have a higher level of acceptance.
- Operations with Maintenance
 - Not getting easy things fixed right away especially comfort issues.
 - Operations never know when an issue will be addressed. It would help if maintenance communicated time lines.

Differences between the operations and maintenance personnel.

- Maintenance tend to feel they are superior because of the schooling they have taken, they are paid more, and have very lucrative retention packages that are not offered to any other group.
- Operations. Tend to have lower expectations, because of lack of training required.

- The foremen in the two groups are a little closer together. However both sides still feel the other has a much easier job.
 - Maintenance Foremen only have to “walk the floor and see that everyone is working”.
 - Operations Foremen only has to “watch shovels dig all day”.
- When asked, Ed agreed that the maintenance foremen are closer to an hourly guy than the ops foremen are.

What ideas or thoughts do you have that could lead to the resolution of these issues

- Need to develop more connectivity between the two groups, especially at the GF and Supt levels.
- More personal contact at the supervisory level. Bringing in maintenance guys and operators for focus group meetings.
- Have the foreman spend time in each other’s shoes.

Kelly Parker. Kelly is the Operations Superintendent at Greenhill's, and has worked in operations for over 29 years in both the North East coal area as well as Coal Mountain in the Elk Valley.

Frustrations of each of the Maintenance and Operations groups.

- Operations with Maintenance
 - There is no sense of urgency in the maintenance group. They want to just plod along at the same pace.
 - The maintenance guys feel that operations never follows up on incidents involving equipment damage.
 - At Greenhill's they have had success in mitigating this one by including maintenance in the investigations and making them aware of the corrective action.
 - Maintenance supervision does not hold their guys accountable.
 - Operations foremen when they are new work under a senior foreman so there is the opportunity for mentoring and training. In Maintenance when a guy takes on the job he is on his own.
 - Foremen spend too much time chasing paper and parts. Once this is corrected they will need to be supported.
 - They don't take full advantage of equipment down time to fix everything they can. They want to just make work orders for everything.

Differences between the operations and maintenance personnel.

- Maintenance
 - Maintenance guys work or spend more time in groups.
 - Maintenance personnel have an educational background and just think differently.
 - Maintenance personnel want to think things through but with no sense of urgency.
- Operations
 - Operators work individually.
 - Operations personnel have worked their way up through the system.
 - Operations personnel want to produce, and are more hands on.

What ideas or thoughts do you have that could lead to the resolution of these issues

- Spend some time in each other shoes to learn what challenges each has
 - Consider having the foremen ride to work together.

Peter Neben. Peter has spent the majority of his (30 year) working career within the maintenance group at Elkview.

Frustrations of each of the Maintenance and Operations groups.

- Maintenance with Operations
 - Operations staff do not understand how maintenance fully works (Some staff seem to care less), poor understanding of how schedule changes effect the maintenance group. (When Maintenance does not get the equipment as scheduled).
 - Operations at times take very little ownership of equipment repairs, very little interaction between operation foremen and operator on the repair.
 - If the repair is the result of an abuse issue, training issue or equipment used incorrectly-wrong type of equipment for the job, the foreman should be involved to correct the issue
 - Maintenance gets many calls with poor information. These calls clearly show that very few questions were asked by the operations foremen about the issue.
 - It appears difficult to get operations to deal with damage/abuse issues. The comment is often heard “That’s the cost of mining”.
 - The maintenance group believes that they document/discipline individuals to a much tighter standard than operations.
 - Operations crews run equipment to the end of the shift that should have been shut down earlier in the shift. The Maintenance group feels that this shows a “Me/Me” attitude, and it certainly does not help the next operations crew or the next maintenance crew that gets the repair. Examples could be grader/dozer edges, seat/glass repairs etc. Sometimes the maintenance group jumps on board with this attitude as well at times (i.e. leaving the repair for the next crew).

Differences between the operations and maintenance personnel.

- Different standards for equipment abuse/damage exist between operations and maintenance.
- Objectives each year are generally different between the two groups. Efforts in 2010 were tried to create some cross functional objectives.
- Maintenance people tend to come from different backgrounds. (trades versus operators.)
- Maintenance tries to be more schedule driven were operations seems to be more reactive.

What ideas or thoughts do you have that could lead to the resolution of these issues

- .“Maintenance Improvement Initiative” will bring the groups closer together.
- The two groups need to share experiences from both sides to enable a better understanding of how each group affects the other. Perhaps some seat time with operations for the maintenance guys and vice versa for the operations guys.
- Sitting in on each other’s planning meetings and secondly tagging along in the pit and shop with each other’s counterpart. It would be interesting to see what the guys would suggest if asked what would be the best way to get to know each other’s tasks/frustrations.
- The quarterly meetings we were holding regularly a while back brought the groups close together.
- Sharing more of the same objectives for compensation may foster/create a working together relationship.

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